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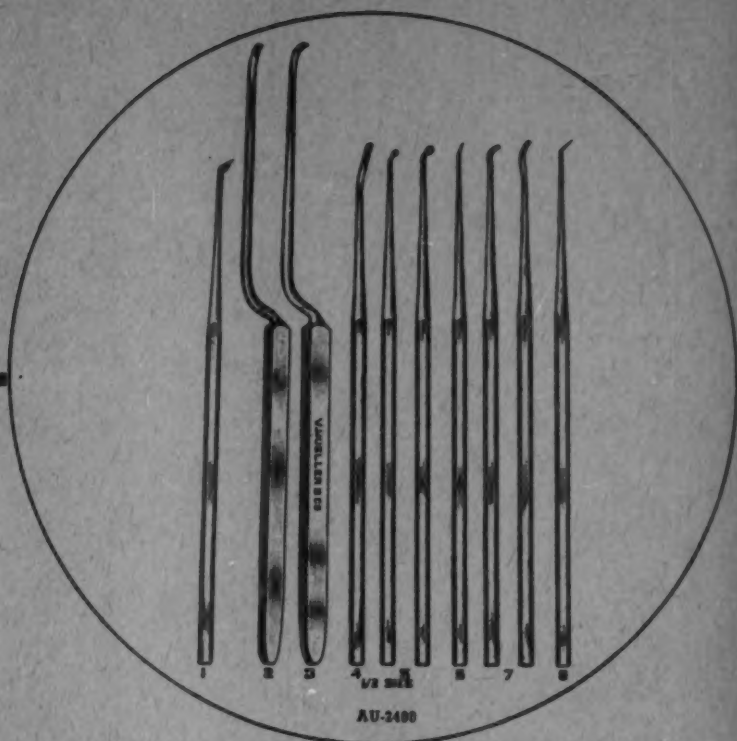
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CARCINOMA OF THE ANTRUM.

An Analysis of 60 Cases with Special Reference
to Primary Surgical Extirpation.*†

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A review of the literature of carcinoma of the antrum does nothing to dispel the opinion of the individual otolaryngologist, gained from his own necessarily limited experience, that this is indeed a depressing disease. One almost never sees a tumor confined to the antrum. In 1942 Watson¹ stated that there had been no opportunity up to that time at the Memorial Hospital to treat the early, small, localized cancer which could be removed surgically with safety to the patient and with reasonable assurance of ultimate control.

Fourteen years later there has been no great improvement in the situation. It is the rare exception to see a patient with early, localized disease. When such cases are encountered, they are discovered accidentally. The great majority of patients are treated for three reasons: 1. because they have delayed seeking medical aid; 2. because the dentists and general practitioners, whom they so often consult first, have treated symptoms rather than referred these patients to otolaryngologists; 3. because otolaryngologists themselves so often lack the index of suspicion which would point to the correct diagnosis.

The treatment of antral malignancy is now more or less

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stabilized, there being almost general agreement that a combination of surgery and irradiation produces the best results, but the results are not likely to show any notable improvement until diagnosis is made more promptly and treatment instituted with courage and without delay.

The extensive literature on carcinoma of the antrum is difficult to analyze for several reasons: One is that much of it is outdated by changes in therapeutic concepts; another is that a large part of it, such as Ohngren's² extensive study in 1933, is not limited to carcinoma of the antrum, but also concerns malignant tumors of the other paranasal sinuses and of the nasal cavity. A great many otherwise excellent reports cover only limited periods of observation, considerably less than the required five years. Finally, there is an almost general failure to provide, in readily intelligible form, the essential data on how many patients are included in the series and how many have survived for five years.

The 60 cases of carcinoma of the antrum, upon which this thesis is based, were collected from two New Orleans hospitals (Charity Hospital of Louisiana at New Orleans, and the Eye, Ear, Nose and Throat Hospital) between the years 1940 and 1955 inclusive, and the Veterans Hospital at New Orleans between the years 1948 and 1955 inclusive. Forty-two patients are known to be dead, after periods of survival under observation and after treatment varying from one month to seven years and five months. In five of these fatal cases only palliative measures were employed. Eleven patients were alive when last seen, but all had disease that was regarded as uncontrolled; none of them could possibly have survived. The remaining seven patients are known to be alive and well for periods varying from three to 12 years and three months after treatment, but only four of these have passed the five-year period.

INCIDENCE.

Carcinoma of the antrum is not a frequent disease. The 60 cases which make up this series were collected over a total of 39 hospital years. There were no cases in the years 1946 and 1947, and 35 of the 60 cases occurred in the last six years

of the 16-year study. When such small numbers are concerned, the yearly distribution is probably entirely due to chance, though better diagnosis may account for the small increase which occurred in the last several years of the investigation. The infrequency of the disease in the New Orleans hospitals is typical. Butlin,³ in 1900, said that there was scarcely a case a year observed at St. Bartholomew's Hospital. At the University of Illinois Tumor Clinic,⁴ only 19 cases were observed in the 1930-1945 period. Seelig,⁵ in a review of the literature published in 1949, stated that up to that date, 517 cases of acceptable cancer of the antrum had been reported, in addition to 107 other cases which might or might not have been cancer.

According to Martin,⁶ malignant tumors of the paranasal sinuses comprise about 0.2 per cent of all human cancer and about 3 per cent of cancer in the upper respiratory and alimentary tracts. Watson¹ reported that 127 patients with carcinoma of the paranasal sinuses had been admitted to Memorial Hospital during the 10-year period between 1928 and 1939, in a total of 26,062 new patients; this was an admission incidence of 0.44 per cent. One hundred five of these cases were carcinomas of the antrum, the disproportion being typical of all reported series of paranasal sinus malignancy. The 68 cancers of the antrum reported by Mattick and Streuter⁷ from the Roswell Park Memorial Institute represented 0.14 per cent of the 48,613 patients admitted over the period of the study. About half of these admissions were for some form of malignant disease, which makes cancer of the antrum represent 0.27 per cent of all cancer. In Welch and Nathanson's⁸ study of the life expectancy and incidence of malignant disease of the lip, oral cavity, larynx and antrum, there were 136 cases of carcinoma of the antrum. All the evidence thus proves that carcinoma of the antrum, both absolutely and relatively, is an infrequent disease and that no single physician can expect to accumulate a large number of cases. In this respect, Larsson and Mårtensson's⁹ study from the Radiumhemmet in Sweden is unique, for the 379 cases of cancer of the paranasal sinuses and nasal cavity in this series represent practically all the cases treated in the country over the period of the survey.

Race. Race has apparently no relation to the incidence of carcinoma of the antrum. In the New Orleans series, in which 53 of the 60 cases were from Charity Hospital with its enormous negro component, there were 32 negro patients. In most of the reported series race is not mentioned, but there were two negroes in the 10 patients with antral cancer reported by Grossman and his associates⁴ from the University of Illinois Tumor Clinic, two in the 68 cases reported by Mattick and Streuter⁷ from the Roswell Park Memorial Institute, and 11 in the 92 cases of paranasal sinus malignancy reported by Hara¹⁰ from the College of Medical Evangelists.

Sex. In the New Orleans series there were 40 males and 20 females, which is in general agreement with the male preponderance in the series of cancer of the antrum or of the paranasal sinuses reported by other observers, including Watson,¹ Mattick and Streuter,⁷ Larsson and Mårtensson,⁹ and Percy.¹¹ There were 33 males in the 47 fatal cases of antral cancer reported by O'Keefe.¹²

Age. In the New Orleans series, the age range was from 24 to 77 years, which is in general agreement with the span represented in most reported series. Only 14 patients in this series were under 50 years of age and 26 were between 50 and 69 years. Twelve-year-old children appeared in the series reported by Grossman and his associates,⁴ Percy,¹¹ and Robin,¹³ while patients of 80 and 85 years of age appeared in the series reported by Percy,¹¹ O'Keefe,¹² Robin,¹³ and Woodward and Archer.¹⁴ The period of youth is apparently one of limited susceptibility, and in all series the largest number of cases occur between 50 and 70 years of age. The significance of the advanced age at which so many of these cases occur is related to the frequency, at this time of life, of organic diseases which may convert patients into poor risks for surgery, regardless of the possible favorable status of the malignant tumor.

ETIOLOGIC FACTORS.

The New Orleans series, like other reported series, makes no special contribution to the etiology of this condition. O'Keefe¹² and Seelig⁵ both mention that the location of the

antra protects them against the ordinary traumatic agents which act upon other portions of the respiratory tract; as a result, the antra are influenced much less than other portions of the upper respiratory tract by exhaust gases, tobacco smoke, irritant dusts, and other occupational and environmental hazards of our modern way of life.

Mollison¹⁵ saw several cases in which it seemed that the existence of a dental fistula, which required frequent irrigation of the antrum, eventually led to malignant disease. Hill and Goodof¹⁶ also observed a case in which there was clearcut evidence that malignant changes had arisen in a fistula which had existed since the extraction of a molar tooth 20 years before; in spite of a constant discharge, the patient had never attempted to have it corrected. There was one such case in the New Orleans series, though the duration was only a few months. The patient was a good surgical risk, and the prognosis was apparently good; but he was treated in 1943, when irradiation therapy was popular, and was mortally ill when last seen. Another patient had had an external draining fistula from the right maxillary sinus, just below the eye, for 15 years, as the result of a gunshot wound. Numerous birdshot were evident in the antrum on roentgenologic examination. This patient, who was also treated by irradiation, is alive and well at the end of 12 years and three months.

Larsson and Mårtensson⁹ make the statement that a fair proportion of cases probably arises from mucosal changes associated with a chronic inflammatory process, though such a history was obtained in only 48 of 330 patients in their series who were questioned on this point. This percentage is probably no greater than the incidence of chronic sinusitis, hypertrophic changes in the mucosa, nasal polypi, allergic rhinitis, and similar conditions would be in the general population, and the theory is obviously not of universal application. It is quite conceivable, however, that any persistent obstructive condition of the nose adjacent to the antrum which might prevent or impede normal evacuation of the secretions might enhance the development of a chronic sinusitis, which might, by cumulative irritation, produce the conditions favorable for malignant change when the patient reached the cancer years.

In Hill and Goodof's case, for instance, the patient had had the antral fistula for 20 years, but he was 41 when malignant changes appeared. In this case, the rapid progress of the disease, the whole course of the illness being nine months, suggested that the malignant changes were of relatively recent origin. In my own case, the patient had had the fistula from a gunshot wound for 15 years, but malignant changes did not appear until he was 48.

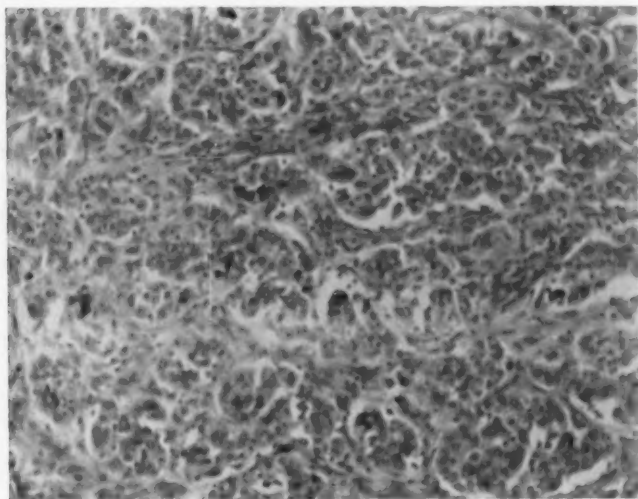


Fig. 1-A. Photomicrograph of section of excised, poorly differentiated carcinoma of left antrum. See Figures 3-A and 3B. Low power.

PATHOLOGIC PROCESS.

Cancer of the sinuses, like most forms of cancer in the upper respiratory and alimentary tracts, is of the epidermoid or squamous-cell variety. This would be expected, since all of the nasal accessory sinuses are lined with the pseudostratified columnar-cell type of epithelium. In the 60 cases in this series, there were nine adenocarcinomas, two transitional cell carcinomas, and one mixed tumor described as a low grade carcinoma. All of the other cases were of the epidermoid or

squamous-cell variety. In 14 cases the malignancy was graded as II or III (Broders) and in 15 other cases the report stated that the tumor was undifferentiated, poorly differentiated, or anaplastic (see Fig. 1). Two of the epidermoid tumors were described as of the Schneiderian type.

These proportions are generally typical of those in other reported series. New,¹⁷ in a discussion of 91 primary tumors

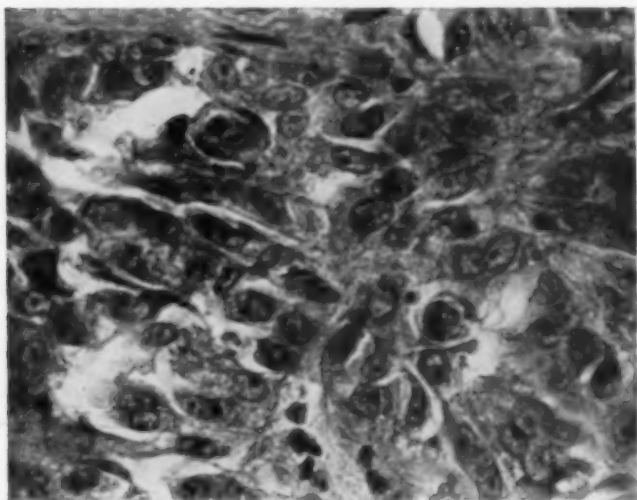


Fig. 1-B. High power.

of the antrum observed in 295 tumors of the upper jaw at the Mayo clinic, commented on the increasing proportion of squamous-cell tumors in the later years of his study; he attributed the increase not to a change in the pathologic process in these cases but to a change in the viewpoint of the pathologist.

The differentiation of cancer types in malignancy of the antrum is extremely important from the standpoint of prognosis. Theoretically, the differentiation is also important from the standpoint of therapy, the advocates of primary

irradiation claiming that the radiosensitivity of highly malignant tumors should give a higher rate of recovery than can be achieved in tumors of the same size but of a lower grade of malignancy. Practically, this is not true. Highly malignant tumors, because of their properties of invasiveness and infiltration, are attended with a lower rate of cure, no matter how they are treated. Often, when the patients are first seen, they have extended well beyond the limits within which irradiation is effective. As Larsson and Mårtensson's⁹ large series showed, poorly differentiated or undifferentiated cancers presented the highest incidence of metastases and had the poorest prognosis, while cylindric cell cancers (adenocarcinomas) were associated with the fewest metastases. All adenocarcinomas in the series grew very slowly, but many of them showed a pronounced tendency to recurrence, often after long symptom-free periods. In one case in the New Orleans series, the patient, who was 34 years of age when she was first seen, presented a recurrence five years after operation. Surgery had been inadequate, though it included removal of the orbital contents. Death occurred two years and three months later.

Origin and Spread. It is often difficult to determine the exact anatomic site of origin of a malignant tumor of the antrum, even by careful examination with the nasopharyngoscope, though this instrument is extremely useful in determining the extent of the lesion. In this series the mode of spread and other evidence suggested that the tumor had originated on the lateral wall in 19 cases, the superior in 16, the mesial in 12, the anterior in five, and on the floor in seven. In one case the point of origin could not be determined at all. In the great majority of these cases the tumor had spread beyond its point of origin.

The area in which cancer of the antrum arises is an area in which this structure, the ethmoid sinuses and the nasal cavity are separated from each other only by thin bony walls. Lesions which originate in one portion, therefore, tend to involve all other portions of the area by direct extension. Cancer which arises on the mesial wall of the antrum promptly involves the nasal cavity. Cancer which arises on the

mesial and superior walls also involves the ethmoids promptly. The superior portion of the ethmoid labyrinth is separated from the orbit only by thin walls, and involvement of the ethmoids is, therefore, usually associated with invasion of the orbit, often quite early in the disease. The cribriform plate then offers the only bar to intracranial extension.

Lymphatic Extension and Distant Metastases. The fairly general belief that carcinoma of the antrum is a localized disease which seldom metastasizes is not warranted by the actual facts. The fallacy has two explanations: 1. Many patients die so promptly of local extension that clinical evidence of metastases is not present. 2. Metastases are present but are not sought for or are not evident except on post-mortem examination. If an autopsy were obtained in each fatal case, the percentage of metastases, as at least three cases in this series show, would rise far above the present recognized levels.

The normal lymphatic drainage of the antrum is chiefly by way of the retropharyngeal lymph nodes, and thence to the superior deep cervical nodes. Cancers involving the floor or lateral wall of the antrum metastasize to the submaxillary lymph nodes, which are easily palpable and readily accessible. Metastases in this area are, therefore, promptly obvious. The enlarged lymph nodes, from carelessness or wishful thinking, may be regarded as infectious, as in two cases in my series, but they are not likely to be overlooked (see Fig. 2-A). Cancers which involve the mesial and upper portions of the antrum metastasize to the retropharyngeal lymph nodes. These nodes cannot be palpated unless they are enlarged and can be visualized by examination of the nasopharynx with the postnasal mirror only if they are considerably enlarged.

In Watson's¹ 127 cases of parasinal malignancy, there were 37 instances of metastases; in 27 of these 37 cases, the growths originated in the antrum. Gross cervical metastases were present in only five cases when the patients were first seen. In the 68 cancers of the antrum reported by Mattick and Streuter,⁷ regional lymph nodes were present in 25 per cent of the cases on the first examination. Braund and Mar-

tin¹⁸ studied the cases of cancer of the upper respiratory and alimentary tracts observed at Memorial Hospital from the standpoint of distant metastases. In 14 cases of cancer of the nasal cavity and paranasal sinuses, the disease remained localized in nine; the other five patients had regional lymph node involvement when they were first seen. Distant metastases, all in cases of epidermoid cancer, were found three



Fig. 2-A. Anaplastic squamous-cell carcinoma of left antrum, with symptoms for two months. Death occurred six months after radical surgery, including maxillectomy, followed by intensive irradiation. Postmortem revealed pulmonary metastases. Preoperative photograph; note enlargement of left maxillary lymph node.

times in the lungs and liver, twice in the pleura, and once each in the pericardium, spleen and kidneys. The average age of patients with distant metastases was slightly less (55 years) than of patients with localized disease (57 years). Patients with distant metastases had a shorter history from the onset of disease to treatment, and from onset to death, than patients with localized disease. The incidence of distant metastases in patients with cervical node involvement on ad-

mission was two-and-a-half times that of patients with only local disease.

If all cases of cancer of the antrum were examined with the care and precision with which Braund and Martin's cases were studied, the findings would probably parallel theirs. In my series, seven patients had involvement of the cervical nodes when they were first seen, one had roentgenologic evi-

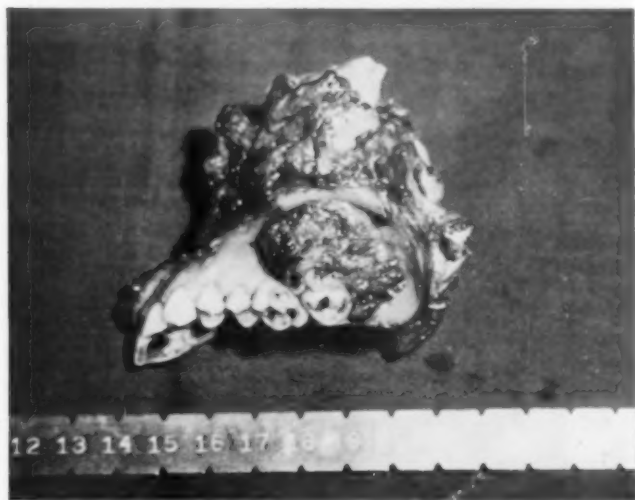


Fig. 2-B. Excised specimen; note erosion of lateral wall of antrum. It was an error in this case not to have removed the orbital contents also, to permit direct irradiation.

dence of pulmonary metastases, and one had both clinical and roentgenologic evidence of metastases to the spine. Ten other patients later developed cervical metastases, and in the cases in which postmortem examination was performed, there were three instances of pulmonary metastases and one instance each of metastases to the thyroid, spine and pancreas. Cerebral extension had occurred in two of the three cases.

Braund and Martin's comment on the brevity of life in patients with distant metastases is strikingly borne out in a

55-year-old colored male in my own series. He was barely able to walk because of a spinal metastasis when he was first seen, three months after the onset of local symptoms, and died three months later. In similar cases of distant metastases reported by MacMahon¹⁹ and by Harbert,²⁰ the duration of life from onset of symptoms to death was four months in



Fig. 2-C. Surgical field before application of skin graft.

each instance. Harbert's patient suffered a fracture of the clavicle, without trauma, four days before admission; in the light of the subsequent history, it was obviously pathological. Only three weeks elapsed in this case between radical surgery and the appearance of spinal symptoms, which suggests that spinal metastases were also present when the patient was first seen. This man, incidentally, had had a chronic nasal obstruc-

tion from childhood, but malignant changes did not occur in the antrum until he was 43 years of age.

Secondary Carcinoma of the Antrum. The single instance of secondary carcinoma of the antrum in this series occurred in a 58-year-old negro woman. It originated in the alveolus and became evident three months after the extraction of a



Fig. 2-D. Surgical field after application of skin graft to under surface of cheek flap.

tooth. Surgery was not adequate. Six weeks later radical neck dissection was carried out on a metastatic lymph node which had been present at the first operation and which had been erroneously assumed to be of infectious origin. This tumor, like the primary tumor, was epidermoid carcinoma, grade II. Five months later there was evident involvement

of the eye, and the patient required gastrostomy for nutrition. Death occurred from malnutrition one year after she was first seen.

Fifty of the 295 cases of parasinal cancer reported by New¹⁷ from the Mayo clinic in 1938 were secondary. The tumors of the antrum, as far as could be determined, had originated in the upper jaw. Of 43 patients operated on and traced, 23, 53.4 per cent, were alive and without recurrence at the end of five years. This is a remarkably good record. More typical is Tice and Beller's²¹ report of 10 cases in which there was only a single five-year survival, though that patient, at the time of writing, had been well for 15 years.

Bilateral Carcinoma of the Antrum. Independent involvement of both antra by malignant tumors is highly unusual. The first case of the kind was reported by Berger,²² in 1945, in a 62-year-old man, who presented a second, totally different, variety of cancer on the left side four months after the removal of a papillary carcinoma, grade IV, on the right side. The patient was apparently well at the time of writing, 17 months after the first operation and ten months after the second. The second malignant tumor, the author commented, occurred "right under his nose," and at least six months was lost because the original finding was minimized; the lesion was thought to be a cyst, and a complete investigation with an opaque medium was not carried out.

In 1950 Grossman and his associates¹ reported a similar case; a transitional cell carcinoma appeared in the left antrum two years after the successful treatment of a squamous-cell cancer on the right side. The patient was well at the time of writing, but had not passed the five-year period.

In two cases in the New Orleans series the patients also had carcinoma of the breast. In the first case, the patient, who had an adenocarcinoma of the antrum, had inadequate surgery, which was followed by metastases to the cervical nodes; when she was readmitted for this condition she was found to have an adenocarcinoma of the breast of the scirrhous type. Death six months later was apparently the result of the antral malignancy. In the second case, radical mam-

mectomy for carcinoma of the breast has been performed four years before the cancer of the antrum became evident. The patient had a pulmonary metastasis at the time of admission, whether from the antral or the mammary malignancy was not clear, and death occurred five months later; the total course of the antral disease was seven months. In a third case, in which the patient had survived for four years and ten months after primary irradiation treatment, carcinoma of the prostate was apparently the major cause of death. The patient had a draining sinus when he was first seen, and a persistent antral fistula, which frequently became infected, and persisted after irradiation, but there was no evidence of recurrent disease at the time of death.

CLINICAL PICTURE.

The most unfortunate consideration in carcinoma of the antrum, just as in other forms of malignant disease, is the rather general acceptance of the late clinical picture as the classical picture. As long as this concept remains general, diagnosis will continue to be delayed, and there will be little improvement in the management of the condition. More accurate is some such classification of symptoms and signs as that advanced by Jacques and Gaudier,²³ as follows:

1. The stage of latency, in which the symptoms consist of aching or neuralgic pain, purulent discharge, epistaxis, polypoid growths about the orifice of the sinus, and in cases of dental tumors, loosening of the teeth.
2. The stage of maxillary deformation, in which there is swelling of the walls of the sinus.
3. The stage of invasion, in which there is destruction of the walls of the antrum, hemorrhage, ulceration, and extension to the skin, pharynx, orbit, skull and lymph nodes.

Pfahler and Vastine's²⁴ list comprises practically all the symptoms and signs which may appear in this condition. They include:

1. A sense of fullness in the nose, with partial or complete nasal obstruction, usually unilateral. There were 22 such

cases in my series, and in 15 cases, not included in this number, a mass was present in the nose.

2. A nasal discharge, either mucopurulent or serosanguineous. There were 12 instances of nasal discharge in my series, in seven of which the discharge was blood-tinged. There were also 17 instances of epistaxis, sometimes frequent, sometimes covering a considerable period of time, and in at



FIG. 3-A. Poorly differentiated carcinoma of right antrum in 66-year-old negro. Preoperative photograph; note swelling of cheek, present for one month, and according to history, patient's only symptom.

least two cases so profuse that the patients had to be hospitalized for emergency treatment.

3. Pain, which will take the form of a headache if the superior portion of the antrum is involved and of neuralgia if the alveolus, antral floor, or the Vth nerve or its branches are involved. Pain may be referred to the teeth and suggests a dental origin. In my own series, 48 patients complained of pain in various locations and eight others complained of headaches.

4. Paresthesia or anesthesia of the cheek when the mid portion of the sinus area is involved. In a case of this kind reported by Anderson,²⁵ a large mass involved the nasal wall and filled two-thirds of the antral cavity. It had extended to the ethmoid cells and the orbit, and a portion of the ethmoid plate was necrotic. In spite of the extent of the tumor, the patient's only symptoms had been numbness of the cheek,



Fig. 3-B. Postoperative photograph after radical surgery, which consisted of en bloc maxillectomy and excision of orbital contents; note excised area in cheek flap, to which tumor had extended. This patient is alive and without evidence of recurrence five years and three months after operation.

extending along the lower jaw, and a burning sensation in the hard palate.

5. Fetid odors if necrosis or ulceration has occurred.

6. Change of voice in the nasal tones, due to nasal obstruction or blocking of the antrum. The patient sometimes sounds as though he had a severe head cold.

7. Alteration or complete loss of the sense of smell.

8. In late stages, expansion or destruction of bone, due to pressure atrophy or invasion by the tumor, with swelling of the face (see Figs. 3-A, 4-A), swelling of the alveolus, and loss of teeth. In 46 cases in my series there was obvious swelling of the face, nose, gum or palate.

9. Ulceration of the nasal tumor, with hemorrhage. Nose-bleed is, however, frequently not a late sign. In a number



Fig. 4-A. Carcinoma of left antrum in 24-year-old white man with six-year history of nasal obstruction and bleeding. Preoperative photograph; note swelling of cheek.

of the 17 cases in my series in which it was present it was a first sign.

10. Invasion of the orbit, with such signs as exophthalmos and proptosis. These signs were present in 15 cases in my series and were sometimes associated with unilateral lacrimation, diplopia, or loss of vision, which sometimes was considerable.

11. Invasion of the skin, with edema and later ulceration.

In four cases in my series, three of which were fatal, the malignancy was evident externally and was associated with a purulent discharge. These cases were in addition to the two cases of antral fistula already mentioned.

12. Local extension to the base of the skull, with consequent neurologic symptoms.



Fig. 4-B. View of interior of mouth 3 years after radical surgery (maxillectomy). This patient is alive and without evidence of recurrence at the end of 3 years and 3 months.

13. Metastases to regional lymph nodes, with dysphagia and dyspnea.

14. Metastases to distant areas, with symptoms and signs varying according to their location.

Except for changes in the voice—which are probably unlisted in many cases because no inquiry is made about them—

there is no symptom or sign in this list which was not present one or more times in the 60 cases reported from the New Orleans hospitals. Swelling about the cheek, nose, eye or forehead was the most frequent first symptom listed, with pain the second. Four patients complained of pain referred to the temporomandibular joint; it can be explained by pres-



Fig. 4-C. View of interior of mouth with prosthesis in place.

sure or erosion of the tumor mass on the branches of the trigeminal nerve. In the case of a 12-year-old boy reported by Grossman and his associates,⁴ the joint had been explored in another hospital, to determine the origin of the pain in this location. The maxillary sinus was not investigated, and when the child was first seen, a year later, he had far advanced disease, with bilateral involvement of the cervical nodes.



FIG. 4-D. Photograph of patient 3 years after excision of maxilla.

At the present time, when the patient with cancer of the antrum is first seen, there is usually moderately tender swelling of the soft tissues of the affected malar region, perhaps slight edema of the lower eyelid, narrowing of the palpebral fissure, and in some instances, proptosis or upward displacement of the globe. Swelling of the gum or palate is frequently immediately obvious when the mouth is opened.

O'Keefe's¹² experience in 47 fatal cases of carcinoma of the antrum is probably duplicated in all reported series, as in my own, that all patients have multiple symptoms on ad-

mission. In his series, analyzed from this standpoint, swelling of the face was present in 44.6 per cent of the cases and of the eye in 17 per cent; pain in the face in 31.9 per cent and in the eye in 12.7 per cent; nosebleed in 27.6 per cent and nasal obstruction in 21.7 per cent; amblyopia, cervical lymph-adenopathy and headache in 8.5 per cent each; and facial paralysis, paralysis of the larynx, and paralysis elsewhere in the body in one case each.

Although pain and swelling are listed as the first symptoms of carcinoma of the antrum in practically all reported series, it is highly questionable, as Cranmer²⁶ emphasizes, that a neoplasm can be completely asymptomatic until it has filled the sinuses and nasal cavity. He believes that early, slight symptoms merely go unnoticed because, in all the cancer educational programs conducted during recent years, the public has not been warned about such possible indications of malignancy as a unilateral nasal discharge, unilateral obstruction, flecks of blood on the handkerchief, occasional nosebleeds, and similar symptoms in patients past middle life and generally healthy. Cranmer also suggests that when patients are first seen, they frequently fail to mention early, apparently insignificant symptoms because they are so engrossed with later, more overwhelming symptoms such as pain, external deformity, and loss of vision. It is true that if the patient is carefully questioned, the existence of early, mild symptoms can frequently be elicited, a situation that once again emphasizes the soundness of Lord Moynihan's warning that a carefully taken history always includes "the earliest departure from health" of which a patient has knowledge.

Grossman and his associates⁴ emphasize that convulsions and personality changes may occur as the result of cerebral involvement, an interesting point which is curiously overlooked in the literature. The possibility must be entertained, they point out, that cancer in the maxillary sinus may produce the same clinicopsychiatric end-results as though the patient had undergone the type of prefrontal lobe surgery now sometimes performed in certain psychiatric depressive states. These changes were present in two of the three fatal

cases in their series, in both of which antemortem euphoria was notable. Late personality changes were observed in two cases in my own series. In one of these cases, the patient underwent an actual transformation of character in the brief interval between two admissions, from a quiet mild-mannered man to a noisy, complaining, blustering braggart.

Four of the patients in the New Orleans series had undergone sinus or nasal surgery in an attempt to relieve their symptoms and eight had undergone extraction of one or more teeth for the same reason, exclusive of two patients who dated the onset of symptoms from extraction of teeth. Another patient, incidentally, considered his symptoms due to a fall two months earlier, in which he bit his cheek. The histories are probably extremely inaccurate on this point, but it is known that in at least four cases the physicians whom the patients first consulted made no serious attempt at diagnosis but tried, instead, to relieve symptoms by such measures as nose drops, or the administration of drugs for pain, or the statement that there was nothing at all the matter. Two physicians, however, and two dentists realized that there was some underlying serious condition and promptly referred the patients to the hospital or to private otolaryngologists. The otolaryngologist who removed a growth from the nose and failed to have it examined is fortunately unique in my own series but all too frequent in medical practice.

The Early Clinical Picture. A recollection of my personal experience, an analysis of the cases in this series, and a review of the literature suggest that the early picture of carcinoma of the antrum varies with the anatomic location of the primary tumor and includes the following symptoms:

1. If the tumor arises in the upper portion of the antrum and involves the superior and mesial walls, the patient will complain of a deep-seated, dull headache, often described as located "behind the eye" on the affected side; unilateral nasal stuffiness, which progresses to complete nasal blockage; excess lacrimation of the eye on the affected side; blurring of the eye, which the patient often describes as "a film" or

"grittiness;" and a mucoid discharge on the affected side of the nose, which gradually changes to mucopurulent and eventually becomes bloody. After these symptoms have become apparent, the more obvious evidences of cancer appear, including swelling of the antral area of the cheek, ocular proptosis, and a nasal mass.

2. If the tumor arises in the floor and lateral wall of the antrum, the patient will complain of a "heavy" feeling in the antral area; aching of the upper teeth, with occasional sharp, radiating pains; tenderness in the upper teeth when he bites down on them; marked tenderness on palpation over the lateral wall of the antrum; and an occasional throbbing temporal headache. As the disease progresses, the nose becomes obstructed on the affected side, but a nasal discharge appears later in cancer of the lower portion of the antrum than in cancer of the upper portion. Bulging of the lateral wall or floor of the antrum is usually a late sign.

DIAGNOSIS.

The results of treatment of cancer of the antrum will probably never be impressively good. I cannot, however, accept the prevalent view that there is nothing to be done about them. They will be considerably improved if diagnosis can be accomplished earlier. In my own series, the duration of symptoms, according to the patients' notoriously unreliable accounts (I regret to say that the internes' and residents' records were equally unreliable in most instances) varied from one day, in a patient admitted as an emergency because of massive epistaxis, to more than two years. Eleven patients were seen within a month, 23 within three months, 14 within six months, and the remainder at periods varying from nine months to more than two years after the onset of symptoms. In O'Keefe's¹² 47 fatal cases, the time between initial symptoms and hospitalization was less than six months in 22 cases, less than a year in 12, and more than a year in 13. In Larsson and Mårtensson's⁹ 379 cases of cancer of the paranasal sinuses and nasal cavities, about 60 per cent of the patients had had progressive symptoms for more than three months and another 20 per cent for more

than six months before the correct diagnosis was made. In Cranmer's²⁰ series, the average patient first consulted a physician three months after the onset of symptoms and was examined by an otolaryngologist, with a view to definitive therapy, seven-and-one-half months after the onset.

In cases of antral cancer in which the duration of symptoms before consultation extends to many months or to a year or more, it will usually be found that the patient has had symptomatic noncancerous disease of the nose or sinuses for long periods of time. In one of my own cases, the duration of pre-existing disease dated from childhood and in another it was more than ten years. One of Cranmer's²⁰ patients had a history dating back 50 years. The danger in these cases is the failure to realize that a condition which was once benign may eventually become malignant. Just as in the cigarette cough that is ultimately a symptom of cancer of the lung, the onset of malignant disease is extremely insidious in such cases because it is masked by the pre-existing condition, and both physician and patient are complacent about it.

Clinical Diagnosis. The outlook in carcinoma of the antrum will be improved if more attention is paid to the following symptoms and signs:

1. Nasal polyps of long standing, particularly when the removal of an apparently simple polyp is attended by bleeding of excessive degree. Failure to examine excised tissues in the laboratory is, as already indicated, an inexcusable omission, which may have tragic consequences.

2. Unilateral nasal blockage, with a mucopurulent discharge and with flecks of blood on the handkerchief, or frank bleeding, when the nose is blown repeatedly or hard. In such cases, as Watson¹ points out, the skin about the nostril on the affected side is often red, cracked, or even ulcerated by the effects of the nasal discharge and the frequent use of the handkerchief.

3. Pain around the maxillary antrum or upper teeth out of proportion to the clinical findings. Carcinoma on the

lateral or posterior wall of the antrum produces pain in the upper teeth early because of involvement of the middle and postero-superior alveolar branches from the maxillary nerve, which run adjacent to these walls en route to the upper teeth.

4. Expansion of the upper jaw from the invasion of the tumor, which makes the wearing of dentures uncomfortable. This is often the first symptom to indicate to the patient that something is wrong.

5. Purulent sinus infections which fail to respond to adequate local and systemic treatment within a reasonable period of time, which should be interpreted to mean not more than three or four weeks at the maximum. In such cases, as will be pointed out shortly, visual investigation of the antrum, followed, if necessary, by biopsy, is the only safe course.

6. Unilateral swelling of the cheek or upper gum.

7. Tenderness over the antrum.

8. Pain in the upper jaw which is dull, persistent, and worse at night, because it is aggravated by the recumbent position.

Not all of these symptoms and signs are early, but if they were properly evaluated, no patient who presents them, particularly in the upper age group, would be dismissed until the presence of a malignant growth of the antrum had been definitely established or excluded. Otolaryngologists should develop a higher index of suspicion about apparently trivial symptoms. In the majority of cases, for instance, nose-bleed can be attributed to local infection, trauma, hypertension, or some other cause for erosion of a nasal vessel, but it is sometimes the first indication of a malignant tumor. A unilateral mass causing nasal obstruction should always be regarded as malignant until it is proved to be otherwise.

Other physicians should also be alert to the possibilities of malignancy of the antrum. Ophthalmologists must remember that patients with unilateral lacrimation require an intensive investigation, including examination of the lacrimal

ducts with an opaque medium. Dentists must remember that pain in the teeth, gums and cheek may indicate malignant disease, even if carious or abscessed teeth are also present. In my own series, as already indicated, and in many reported cases, pain that continued after diseased teeth had been removed was often not properly evaluated. In two cases in my series, the sequence stated by the patients



Fig. 5. Carcinoma of antrum of six months' duration; note erosion through floor of antrum and hard palate.

was extraction of teeth followed by persistent pain, and in two of Moffett's²⁷ 15 cases of parasinal disease, the same sequence was observed.

The local examination should be conducted with special care. Areas of frank erosion (see Fig. 5) are not likely to be overlooked, but insignificant areas of bulging (see Fig. 6) may be. Watson¹ mentions as a diagnostic sign the thinning of the anterior wall of the antrum, which may permit it to be invaginated by moderate pressure, just as the surface of a pingpong ball can be similarly depressed.

The local examination should always include the use of the nasopharyngoscope. It may not always be possible, as already mentioned, to determine the point of origin of the malignant tumor, but it is always possible to study the ethmoid labyrinth and to decide whether this area is involved. This is a simple diagnostic method, but it is one that the



Fig. 6. Carcinoma of antrum of two months' duration; note bulging of lower lateral antral wall. This patient also had a papilloma of the palate.

average general surgeon or general practitioner is not trained to use.

Roentgenologic Examination. All patients with suspected malignancy of the sinuses should have routine roentgenologic examinations in the chin, nose and lateral projections. The ordinary posteroanterior views of the whole head and lateral views with the Potter-Bucky diaphragm are useful for general orientation, but films which include large areas do not usually contain enough detail for diagnosis unless the disease is far

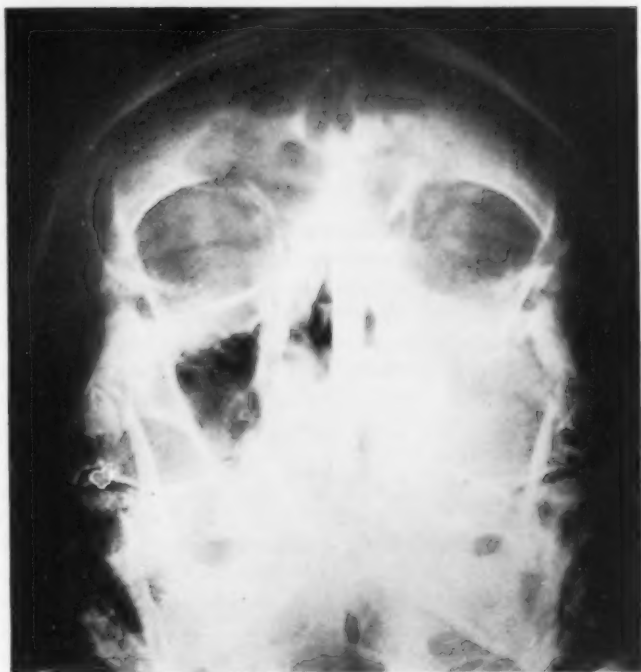


Fig. 7. Carcinoma of left antrum. Anteroposterior roentgenogram showing opacity of antrum, involvement of ethmoid labyrinth, and erosion of superior, lateral and mesial antral walls. See also figures 22-A and B.

advanced. Additional roentgenograms at various angles are necessary to show both bone and soft tissue detail.

The first step in roentgenologic diagnosis, as Pfahler and Vastine²⁴ emphasize, is for the roentgenologist to be constantly aware of the possibility of malignant disease of the antrum. Diagnosis is based on three findings: 1. increased density of the sinuses or nasal cavities; 2. expansion or destruction of bone, and 3. irregularity of soft tissue outlines. The latter change can be demonstrated only by the use of an opaque medium, a technique which is not employed as often as it should be. If the first films are not conclusive, the antrum should be washed out before others are made.

Cancer of the antrum is a soft-tissue growth. In its early stages, the shadow which it casts cannot be distinguished from the shadow cast by an inflammatory lesion. Opacity of a localized area, therefore, does not mean malignancy, though it is likely to be present in all malignant disease, as it was in the 59 cases in my own series in which X-ray reports are available.

The first positive roentgenologic sign of malignancy of the antrum is bony destruction (see Fig. 7) which, unfortunately, is not an early sign. Here the distinction between benign and malignant disease is usually simple, for the bony change of benign disease presents as faintness of the shadow cast by the involved portion, as the result of decalcification. In my series, bony destruction, sometimes very extensive, was evident in 45 of the 59 cases in which films were available. Only one five-year cure occurred in this group.

A positive report of cancer, based on bony destruction, was returned in 83 per cent of the 112 cases in Watson's¹ series in which stereoscopic studies were made. In the 68 cases reported by Mattick and Streuter,⁷ clouding of the antrum was evident in 60 cases, including all seven five-year survivals. Sclerosis and marginal irregularity, or both, were noted in 25 cases, including four of the seven five-year survivals. Bony destruction, which was noted in 23 cases, was apparently of bad prognostic import in this series. There were no five-year survivals in this group; only one patient survived four years, and the average patient died within 12 to 18 months. Larsson and Mårtensson⁹ found no demonstrable roentgenologic changes in the bone in only 20 of their 379 cases of cancer of the paranasal sinuses and nasal cavity, and in six of these the malignancy was limited to the nasal cavity. Since the results were practically the same in cases with roentgenologic signs of destruction in the ethmoid or the posterior wall of the maxillary sinuses and those without such signs, they considered positive findings in the bone no contraindication to operation. This is the general position.

All patients with cancer of the antrum should, of course, have routine roentgenologic examinations of the chest and spine before any treatment is instituted.

Biopsy. Examination of every specimen removed from the nose and sinus should be routine, no matter how often polyps may require removal. The fact that previous examinations have been negative makes no difference. Almost every reported series, like my own, contains one or more cases in which failure to observe this precaution produced serious consequences. Also, as Havens²⁸ pointed out, a nega-



Fig. 8. Visualization of maxillary sinus through Caldwell-Luc incision in suspected malignant disease. Instrumental palpation is possible through this incision, and a specimen can be obtained for histologic examination.

tive report on a tumor which obstructs the nasal passage is not conclusive; the anterior portion of such a tumor is frequently partially necrotic and the pathologist may have no opportunity to determine, in the material submitted to him, that cancer is present. Formal biopsy from an ulcerated area on the cheek or in the mouth is, however, often definitive.

Perhaps the simplest means of improving the diagnosis of cancer of the antrum is, as already mentioned, to cease to treat indefinitely a maxillary sinusitis which does not respond

to adequate treatment within three to four weeks. If there is no response by this time, the next step should be to make a Caldwell-Luc incision just above the tooth line through the anterior wall of the maxillary sinus, open the sinus through a small incision, and visualize it thoroughly with a head light (see Fig. 8), or palpate it with a ball-pointed probe. If the findings warrant it, a biopsy should be taken and the incision closed tightly. If the biopsy is positive, the incision at the radical operation is made slightly higher than it is usually made, and the Caldwell-Luc incision is included in the tissues which are removed. If this technique is followed, the charge sometimes made against biopsy, that it spreads cancer cells, is not valid.

Biopsy is essential in every case of suspected antral carcinoma. Reliance on frozen section at operation is safe in the hands of a pathologist of skill, experience and judgment, but all pathologists do not possess these qualities. Furthermore, the surgery required for cancer of the maxillary sinus is too radical to be undertaken without full proof of the necessity for it, while the reverse risk of failure to make the diagnosis is also too serious to be left to any chance.

Havens²⁸ offers another sound piece of advice concerning biopsy. If the tumor is small, he says, and the physician who sees the patient first has reason to think it is malignant, he should ask himself, "If this is malignant, am I going to take care of it?" If the answer is "no," Havens continues, the physician should not make the biopsy but should send the patient at once to the specialist of his choice, so that he may see the lesion in its original state and make his decision about diagnosis and possible treatment before its appearance has been obscured by the inflammatory reaction which follows biopsy.

Other Diagnostic Methods. Aspiration biopsy is of value when it is positive but is of no value at all when it is negative. It may be employed in suspected cases as a first step in diagnosis, but should always be followed by formal biopsy. It was used in only one case in this series, to confirm the diagnosis of metastatic extension to a lymph node. In the

127 cases of parasinal disease reported by Watson¹ from Memorial Hospital, aspiration biopsy was positive in 39, but significantly, was negative in four cases.

Cytologic diagnosis by the Papanicolaou technique was first employed in cancer of the maxillary sinus by Fitz-Hugh and his associates²⁹ in 1950. The 72 cases of antral disease which were studied included six instances of carcinoma. All reports were positive, but in all cases the disease was so advanced that diagnosis presented no problem. In 1952, Armstrong³⁰ reported four cases in which the diagnosis had been made by this technique. In two cases, although pathologic changes included osteolytic changes in the bone, the roentgenologic report was chronic maxillary sinusitis, and in one case the first biopsy specimen had been reported as negative. Cytologic study was used in eight of the cases reported by Cranmer.²⁶ The report was uniformly positive when the tumor was obvious in the nose, but with a single exception, was negative when the mass was not evident clinically. Cranmer doubts that this technique will ever be very useful.

In the single case in my own series in which this method was used, cytologic study was positive, and the diagnosis, which had been evident clinically, was later confirmed by formal biopsy. This is a useful adjunct method, particularly when the patient is under treatment for a chronic or acute sinus condition which does not clear up promptly; but it should be used with the proper precautions and should be confirmed by formal biopsy. Neither in this method nor in aspiration biopsy should time be lost in a repetition of tests which have been reported as negative, and a negative test, as already emphasized, should never be accepted as conclusive.

Differential Diagnosis. In most cases of cancer of the antrum the differential diagnosis furnishes no problem because the condition is so obvious. Theoretically, however, it includes chronic sinusitis, mucocoele, benign tumors, specific infections, secondary malignancy, osteomyelitis, simple osteitis and periostitis, foreign bodies, forms of syphilis and tuberculosis, nasal polypi, Vincent's angina, allergy, and neuralgia, including tic douloureux.

PRINCIPLES OF MANAGEMENT.

The early treatment of carcinoma of the antrum was entirely surgical. The immediate postoperative mortality was distressingly high, and the results were not good, though it is not fair to say that they were altogether bad. They were better, in fact, as Butlin³ said in 1900, than might have been

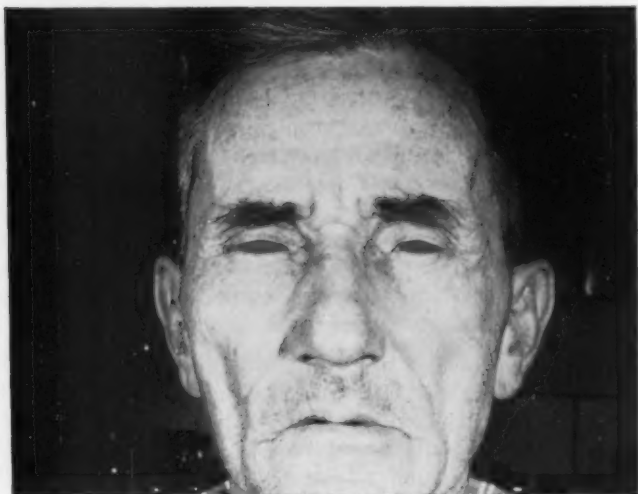


Fig. 9-A. Epidermoid carcinoma, grade II, of right antrum, in 54-year-old man. The malignancy was discovered in the course of a sinus operation, at which polyps removed from the nose were found on histologic examination to be malignant. The patient was in a State institution and had no treatment for 15 months after the onset of symptoms. Preoperative photograph.

expected. In a follow-up study of 14 patients with this condition observed at St. Bartholomew's hospital and treated by maxillectomy, two were alive and well over a less-than-three-year period and three others were alive for more than three years. Butlin also cited the results at the Göttingen Klinik of total resection of the upper jaw of 72 patients subjected to this operation; 23 died after it but 14 were alive and well for more than three years. The follow-up is inconclusive by modern criteria, but the results are rather remarkable for

an era in which the refinements of modern surgical technique and modern supportive therapy were lacking.

Because of the high mortality and the poor results of surgery, irradiation became very popular after modern high-voltage machines became available, and for a considerable time it was the more popular method of treatment. In recent

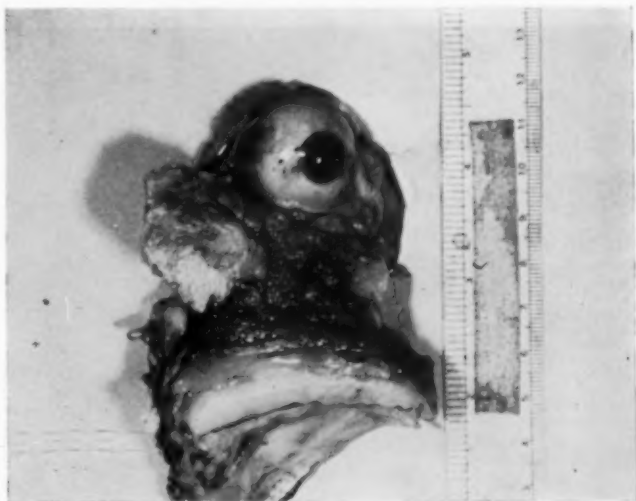


Fig. 9-B. Excised specimen consisting of maxilla, portion of zygoma and orbital contents.

years the pendulum has swung back to the middle ground, and the most universally used method of management today is radical surgery followed by irradiation. This is the logical position, for a number of reasons:

1. The rationale of surgery is that a malignant neoplasm originates, and exists for a certain period of time, as a localized lesion, amenable to resection and curable by total excision. That this is an ideal situation and not an actual one is proved by Watson's¹ statement, already cited, that up to 1942, no such case had been observed at the Memorial Hos-

pital. This type of growth, as he observed, is usually discovered by accident, during operation for supposed benign sinusitis or nasal polypi. There were two instances of this sort in my series (see Figs. 9, 10), one numbered among the five-year cures. In another case, nasal polypi were discovered during a complete physical examination for jaundice. When they were removed and reported as malignant, the



Fig. 9-C. Photograph one month after radical surgery (en masse excision of maxilla and orbital contents). The patient died seven and a half months later, of recurrent carcinoma and an abscess of the right frontal lobe.

patient literally killed herself, for she steadily declined surgery, submitted only to limited irradiation, and finally placed herself at the mercy of the Hoxsey clinic.

2. Anything but radical surgery is inadequate surgery. The extent of the disease, because of microscopic extension, is practically always greater than clinical or roentgenologic evidence indicates. By modern standards, adequate surgery includes removal of the maxilla.

3. A reasonable degree of selection of cases must, of course, be exercised. The patient must be expected to survive the operation, a criterion which can usually be met today, and there must be a reasonable chance of excising the growth, or at least enough of it to make him more comfortable for whatever period of life remains to him. Cosmetic considerations must be entirely ignored. Generally speaking, while



Fig. 10-A. Carcinoma of left antrum in 39-year-old white man who is alive and without evidence of recurrence five years after maxillectomy. The malignant disease was discovered accidentally, in the course of a submucous resection, when suspicious-looking tissue was discovered along the floor of the left nasal fossa and the posterior portion of the left inferior turbinate and a specimen was removed for examination. Post-operative defect.

the chances of success and the possible lethality of surgery must be evaluated, they must not be given too much weight. When one is dealing with a disease of desperate potentialities, desperate measures must be taken. For this reason, the fact that a patient is old, debilitated, or has organic complications must not be given too much consideration. As Ohngren² put it, recurrence is so frequent in malignant tumors of the maxillo-ethmoidal regions that the physician does the patient

a greater service by keeping him alive for months or years than by allowing him to be buried promptly with an almost invisible scar.

A certain amount of discretion is nonetheless necessary. One patient in my own series, a 75-year-old white man, had had two recent coronary occlusions, had advanced disease which had extended to the cervical lymph nodes, and ob-



Fig. 10-B. Photograph six months after operation (maxillectomy).

viously had little chance of relief or cure by surgery. While it was sound judgment to treat him by irradiation rather than by radical surgery, such cases should be selected with great care. Good results are sometimes achieved in the most hopeless-seeming cases. Larsson and Mårtensson,⁹ for instance, reported 13 cases in which radical surgery was impossible but in two of which five-year survival occurred.

4. It has already been pointed out that while theoretically, high-grade, radiosensitive tumors would be best treated by irradiation alone, this is rationalization which promptly

breaks down in the face of facts. Larsson and Mårtensson,⁹ writing from a country in which irradiation was for a long time the accepted method of treatment, stated frankly that no matter how their extensive series was analyzed, combined surgery and irradiation gave better results than irradiation alone. Schall,³¹ in 1948, found that surgery plus irradiation offered a better than two to one chance of five-year survival as compared with primary irradiation.



Fig. 10-C. Prosthesis.

5. Aside from the question of survival, cancer-lethal doses of irradiation are almost inevitably followed by serious complications, including pansinusitis, infection, necrosis of bone with sequestration, ocular edema, and panophthalmitis. The fundamental defect of irradiation therapy which is not combined with surgery is that it is impossible to kill cancer, once it has invaded the bone, without producing bony necrosis and making the last state of the patient worse than his first.

6. As Martin⁶ has pointed out, growths which arise in the

mucosa of the paranasal sinuses are infected from their time of origin. When drainage is blocked, suppuration follows. When this situation has developed, wide surgical excision and drainage are eventually required. If the drainage procedure is to be adequate, it must be so radical that it amounts, in effect, to radical resection, and the procedure finally adopted would probably have been sufficient to effect permanent control of the growth if it had been used originally. In the light of this chain of events, the more logical plan is to resort to radical surgery first and to follow it by X-ray or radium therapy as necessary.

7. A second reason why irradiation is less desirable than surgery is that when it is used, it is not possible to identify the full extent of the lesion and as a result, treatment is frequently inadequate. Even when the lesion is fully visualized, marginal extensions to the pterygoid fossa, the ethmoid cells and the floor of the orbit are not infrequently overlooked.

8. The cardinal principles of surgery are that operations should be in one stage and removal *en masse*, not in stages and by morcellation. All experimental evidence indicates that when a malignant lesion is traumatized, malignant cells are distributed, and both local extension and metastases to lymph nodes and more distant structures are favored.

Schuknecht³² has well stated the principles of operation combined with irradiation as necessary. The criteria for operability of a particular lesion, he says, are determined to a considerable extent by the surgeon's skill and courage. Whether diathermy or cold steel is used is not as important as that the surgical exposure be wide and resection complete, or as complete as possible. Complete resection, of course, is impossible when the base of the skull has been invaded or when the lesion is adherent to the walls of the nasopharynx.

SURGICAL TECHNIQUE.

Total removal of the maxillary sinus is necessary for the cure of carcinoma of this sinus. Total removal of the sinus

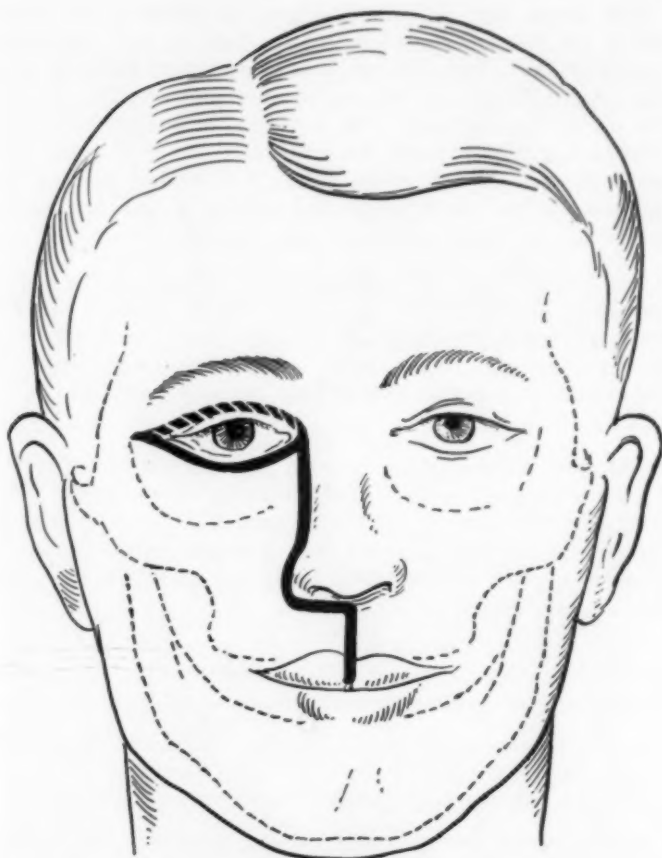


Fig. 11. Incision for radical surgery (maxillectomy) for carcinoma of antrum. Broken line indicates incision employed when en masse removal of orbital contents is part of operation.

is impossible without total removal of the maxillary bone. Any surgery which is not based on this concept is not adequate surgery.

Exposure of the facial surface of the maxilla, which is the first step of the operation, is accomplished as follows:

The initial skin incision is begun by splitting the upper lip in the midline superiorly to the base of the columnella (see Fig. 11). The incision is then continued laterally at a right angle beneath the base of the nose and is curved around the ala in the alar-facial fold to ascend superiorly along the side of the nose toward the inner canthus to a point just above the inferior rim of the orbit. The incision then curves laterally on the lower eyelid and follows a line just below the border of the lid out to the zygomatic bone.

The incision in the mucous membrane is begun at the superior aspect of the lip-splitting incision and is extended beneath the upper lip in the gingivolabial fold to the posterior border of the maxilla. If the patient has already undergone a Caldwell-Luc operation (see Fig. 8), the new incision is made just above that incision.

The flap outlined by the incision just described is reflected from the anterior surface of the maxilla, to which the periosteum is left attached. If the malignant process has already invaded the flap, the affected area is at once excised, at least 1 cm. of grossly normal tissue being left around the evident limits of the lesion (see Fig. 3-B).

The zygomatic bone is exposed and the orbital periosteum is reflected from it. The maxilla is then mobilized by freeing it from its bony and soft tissue attachments.

A Gigli saw is introduced through the inferior orbital fissure, under the lateral rim of the orbit (see Fig. 12) and is anchored on the posterosuperior surface of the zygoma.

Sectioning of the zygomatic bone is begun in an antero-mesial direction and follows essentially the line of articulation between the zygoma and the maxilla. Enough of the orbital rim is thus preserved (see Fig. 13) to prevent subluxation of the orbital contents and subsequent diplopia, which would otherwise be inevitable. As much as possible of the zygomatic arch is preserved by transecting the body of the zygoma close to the maxillary junction (see Fig. 14).

The coronoid process of the mandible is then transected with the Gigli saw just below the insertion of the temporalis

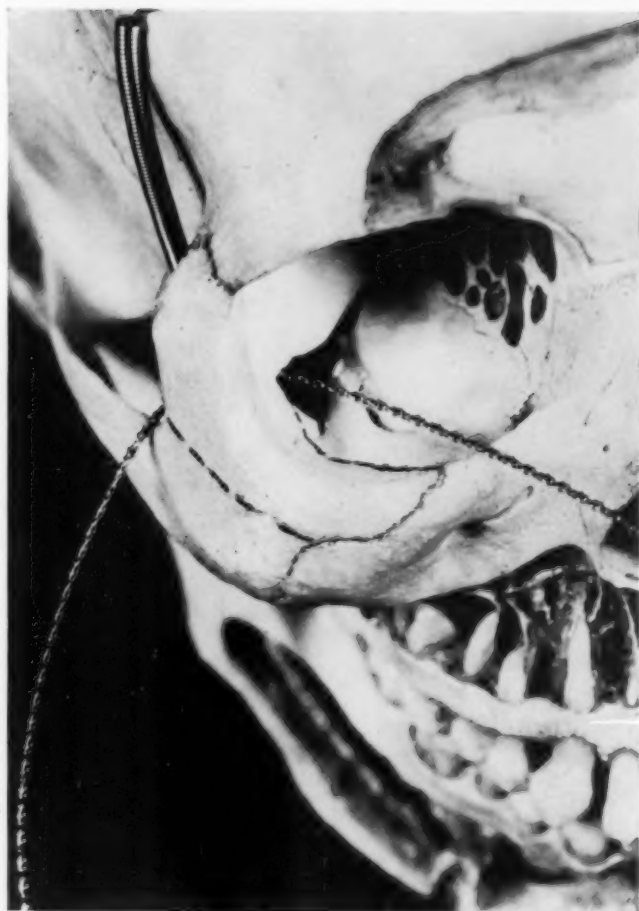


Fig. 12. Gigli saw introduced through intraorbital fissure and anchored on posterior surface of zygoma. Broken lines indicate lines of sectioning of orbital rim.

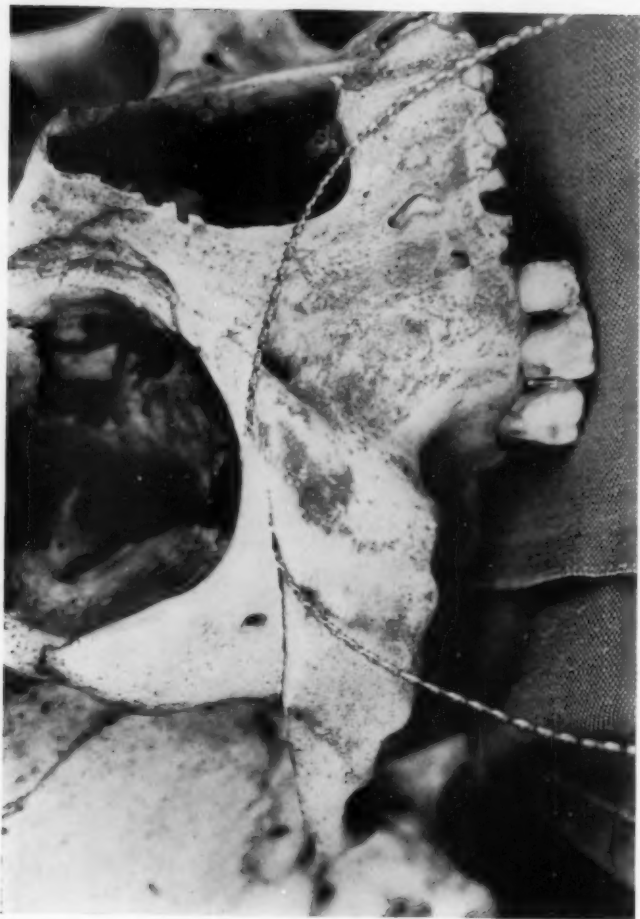


Fig. 13 Completed sectioning of bony orbital rim.

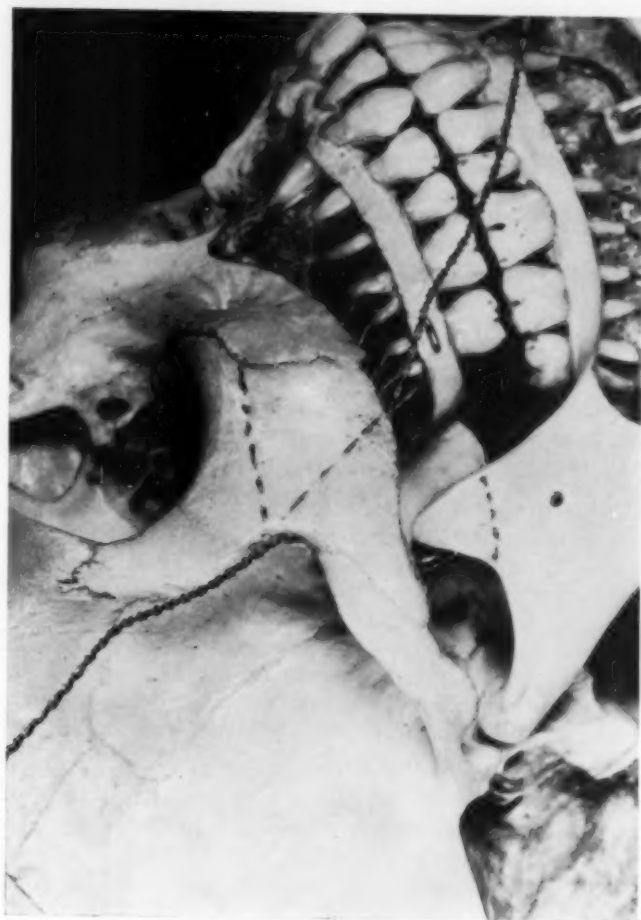


Fig. 14. Transaction of body of zygoma close to maxillary junction. Note preservation of zygomatic arch.

muscle (see Fig. 15). ✓ Access is thus afforded to the internal maxillary artery, which is identified, clamped, and ligated on the superficial surface of the external pterygoid muscle. Section of the coronoid process also lessens possible post-operative trismus.

The superomesial soft tissue attachment of the maxillary bone is now freed by incising the mucoperiosteum along its sharp anterior border up to the nasal bone. Then a straight bone-cutting rongeur is introduced, and the frontal process of the maxilla is sectioned at the level of the lacrimal fossa (see Fig. 16). The intranasal line of section is just above the middle turbinate and anterior ethmoid cells and just below the cribriform plate (see Fig. 17). This technique, which permits the removal of all potentially malignant tissue *en masse*, provides for removal of microscopic extensions of the malignant process into the anterior ethmoid cells, which are thus removed along with the mesial wall of the maxillary sinus.

At this point of the operation, the control of bleeding becomes a matter of first importance. The blood supply of the maxilla, it will be recalled, is principally from the internal maxillary artery and its terminal branches; it also has a wide anastomotic blood supply. Ligation of the internal maxillary artery provides sufficient control of the local blood supply only in simple maxillectomy. It is never adequate when removal of the orbital contents is necessary, and is sometimes inadequate for even the simpler operation.

Routine preliminary ligation of the homolateral external carotid artery to secure hemostasis is not advisable. In the first place, it is not always necessary. In the second place, while it reduces the blood supply to the maxilla, it does not control it *in toto* because of the anastomoses which supply blood from the contralateral side. Finally, if radium or X-ray therapy are necessary, the chances of necrosis are enhanced when a large portion of the local blood supply has been cut off.

In our experience, the simplest way to reduce the blood supply during the later stages of an operation in which bleed-

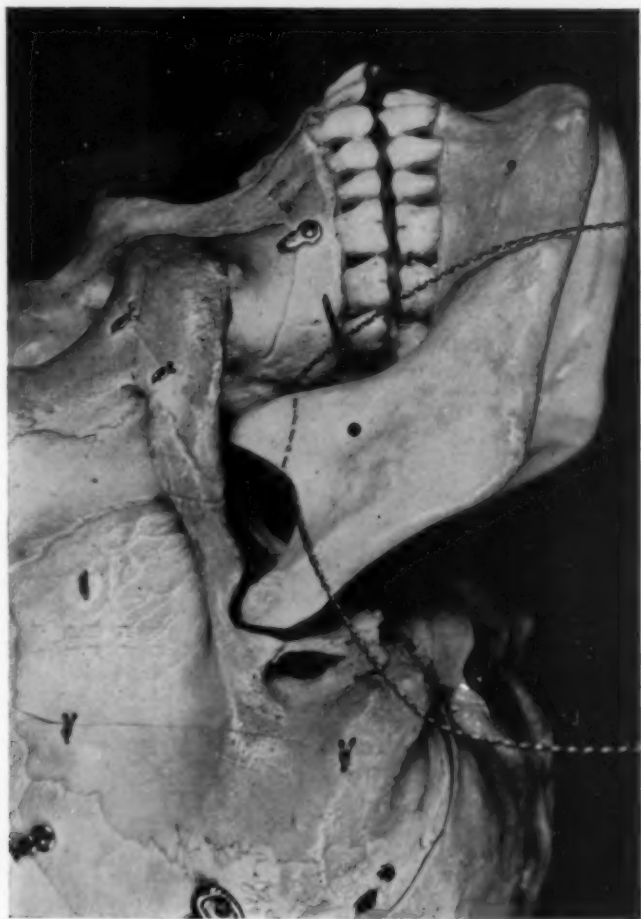


Fig. 15. Transection of coronoid process of mandible just below insertion of temporals muscle. This step, which was suggested by Dr. Edwin W. Cocke, Jr., provides access to the internal maxillary artery.



Fig. 18. Sectioning of frontal process of maxilla at level of lacrimal fossa.



Fig. 17. Intranasal line of section just above middle turbinate and anterior ethmoid cells and just below cribriform plate.

ing threatens to be troublesome is by the use of controlled hypotensive anesthesia, by the technique employed by Dr. John Adriani, Chief Anesthetist at Charity Hospital of Louisiana at New Orleans.

This is a technique which should never be undertaken except by an experienced anesthetist. It should not be used routinely, for it is not without the risks always associated with hypotension, though these risks, when an experienced anesthetist is in charge, are minimal, and we have never observed them. Hypotensive anesthesia should not be used in operations of limited extent, in which hemostasis can be effected by standard techniques. It should be used routinely, however, in operations in which the orbital contents are resected in continuity with the maxilla and in any other operation in which the blood loss threatens to be heavy and bleeding is likely to obscure the field and interfere with the operative maneuvers. All blood lost must, of course, be promptly replaced, but in our experience, the use of this type of anesthesia reduces the loss, on the average, from three pints per patient to one pint.

Dr. Adriani's technique is as follows: About 10 minutes before the part of the operation during which bleeding and oozing are likely to be troublesome, Arfonad (brand of Trimethanaphan camphorsulfonate), which is a ganglionic blocking agent, is introduced rapidly into a vein of the arm or leg, as may be most convenient. Since Pentothal sodium (Thiopental sodium) combined with nitrous oxide and oxygen is the anesthetic of choice, a needle is already in the vein. Arfonad is used in a solution of 2 mg. per cubic centimeter and enough is used (on the average between 100 and 150 mg.) to reduce the systolic blood pressure to below 80 mm. Hg. After the initial hypotensive dose has been introduced, the infusion is adjusted to maintain the systolic pressure between 60 and 80 mm. Hg. Positioning of the head (head-up position) is helpful in maintaining the blood pressure within the desired range. Blood is replaced according to the calculated loss.

During the period of hypotension, which should not exceed

one hour, bleeding occurs only from the larger vessels, and they bleed only slowly. There is no capillary bleeding during this period. When it recurs, after the period of hypotension, it is readily controlled. The usual anesthesia is continued while the hypotension is effective; as a rule, there is a notable reduction in the amount required. Normal blood pressure is restored by the use of some vasopressor agent, such as ephedrine or neosynephrin.

Before the hard palate is sectioned, the mucous membrane is incised, the incision commencing at the posterior aspect of the gingivolabial incision and extending through the soft palate to the midline, just below the junction of the soft and hard palates. Whenever the circumstances permit, a rim of soft palate is preserved, to facilitate the later fitting of a watertight prosthesis.

The Gigli saw is now passed over the floor of the nose (see Fig. 18), around the hard palate, through the incision in the soft palate, and into the mouth. The bony palate is then sectioned in the midline, close to the base of the septum (see Fig. 19). The mesial and lateral pterygoid plates of the sphenoid bone are sectioned 1 cm. above the hamulus pterygoideus with a 7-mm. straight chisel (see Fig. 20), care being taken to avoid damage to the internal maxillary artery.

The final step before delivery of the maxilla is severance of the muscle fibers of the masseter and internal pterygoid muscles and reflection of the orbital periosteum from the superior maxillary surface. The maxilla can then be delivered (see Fig. 21) by grasping it with a heavy biting forceps, rocking it out of position, and exerting posterior pressure on it digitally.

When the maxilla and other tissues have been removed (see Fig. 2-B), the whole field (see Figs. 2-C, 22-A) is carefully examined. Although extension of the malignant tumor into the sphenoid sinus is not common except in advanced stages of antral cancer, the front face of this sinus is always removed and the lining membrane is extracted. The nasofrontal aspect of the floor of the frontal sinus is also removed, even though the antral lesion seldom extends to this

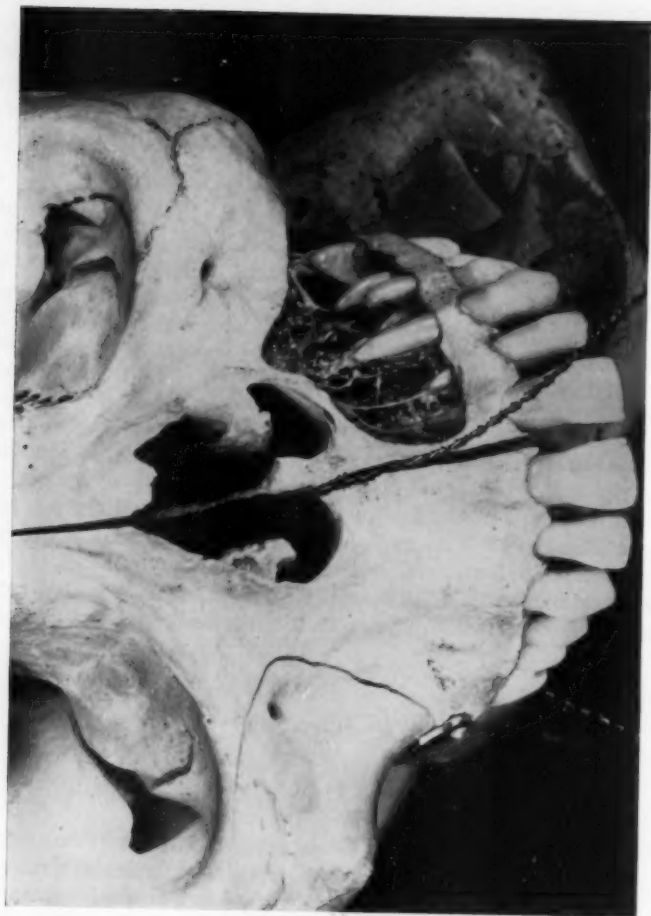


Fig. 18. Passage of Gigli saw over floor of nose around hard palate through incision in soft palate and into mouth.

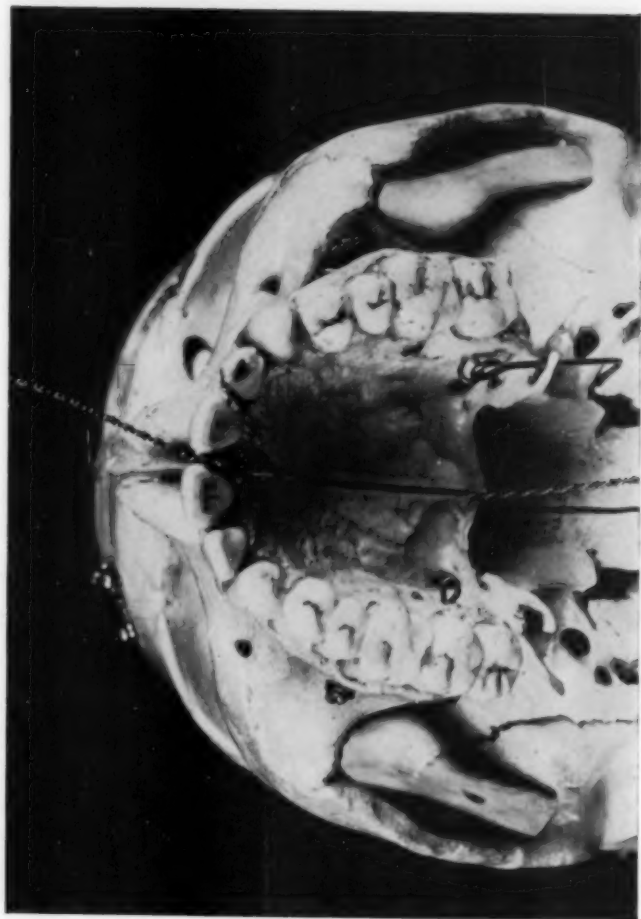


FIG. 12. Sectioning of bony palate.



Fig. 20. Sectioning of medial and lateral pterygoid plates of sphenoid bone above hamulus pterygoideus.



Fig. 21. Delivery of maxilla.

sinus, in order to establish adequate drainage for the secondary infection ordinarily present. If there is evidence of extension, the whole floor of the sinus and the lining membrane are removed.

If the tumor has extended through the posterior wall of the antrum into the pterygoid area, the pterygoid muscles are removed. The prognosis in such cases is obviously poor.

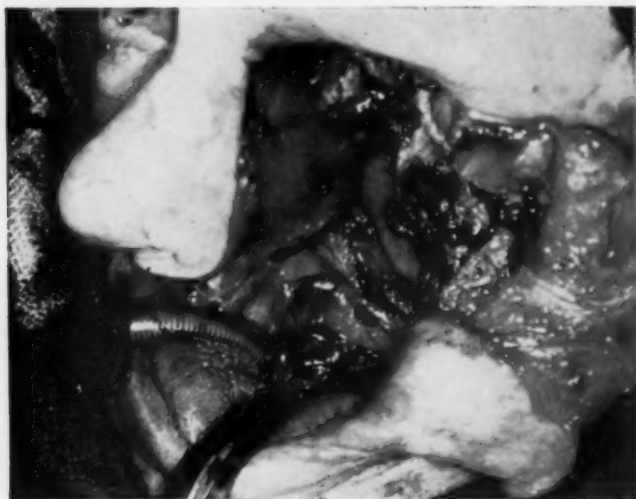


Fig. 22-A. Carcinoma of left maxillary sinus (squamous-cell, grade II). Radical surgery was performed in this case after irradiation had failed, to relieve intractable pain. Death occurred ten weeks after operation from cerebral extension of the tumor. Surgical field after excision of maxilla and orbital contents and before application of skin graft.

After the excisional surgery is completed, electrocoagulation is employed on all suspicious areas, particularly areas in which it is feared that the lines of dissection are not entirely adequate.

As Frazell³³ has pointed out, the use of skin grafts is one of the important recent advances in radical surgery of the maxillary antrum. If all mucosa is removed, these grafts thrive equally well on the cheek flap, the bare bone, the dura,

or the cerebral cortex. Their use simplifies postoperative packing of the cavity by making the area less tender, and improves the toleration of the prosthesis to be applied later. It also improves the cosmetic result; if a skin graft is omitted, shriveling or scarring over the surgical area may be conspicuous (see Fig. 23).

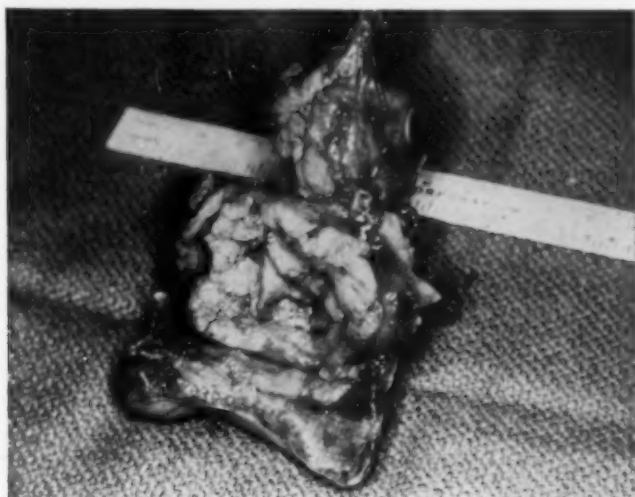


Fig. 22-B. Excised specimen, consisting of maxilla and orbital contents; note cancer tissue filling antrum.

The graft is taken from the lateral aspect of the thigh with an electric dermatome. It is applied to the under surface of the orbital periosteum and the orbital rim as well as all denuded areas in the operative site (see Fig. 2-D). It is perforated at intervals to prevent pocketing of serum beneath it, and is sutured in place with plain 000 catgut.

The original skin incision is closed with interrupted sutures of 000 black silk. Great care is taken to assure accurate reapproximation of the flap. The cosmetic results are frequently excellent (see Fig. 4-D). In fact, the only real disadvantage of maxillectomy, and it is not very noticeable, is

that removal of the muscles innervated by the buccal branches of the facial nerve destroys the elevator function of the adjacent upper lip and the movements of expression in the cheek.

The surgical cavity is packed with moderately firm pressure with a medicated wool pack,* to exert even pressure on the skin graft and to seal off the palatal defect.



Fig. 23. Carcinoma of left maxillary sinus. Photograph three months after radical surgery (maxillectomy). A skin graft was not used in this case; note resultant shriveling of cheek flap.

Excision of Orbital Contents. The necessity or possible necessity of removing the orbit along with the maxilla always introduces a painful decision, even when the indications for removal are entirely clearcut. The surgeon should be absolutely frank with the patient. If the indications are clearcut, he should be informed of the necessity. In the majority of

*The use of this pack (Cornish hemostatic pad, Cornish laboratories, Berkeley, California) was suggested to me by Dr. Edwin W. Cocke, Jr.

cases, careful clinical examination, supplemented by roentgenologic examination, will permit a preoperative decision. If it does not, the patient should be told that every effort will be made to preserve the eye, but that it may be necessary to remove it as a life-saving measure, either because it is involved in the malignant process or because it is necessary to apply irradiation through the socket. In any event, the patient's permission for removal of the orbital contents should be secured in writing before the operation.

The eye should be removed under the following circumstances:

1. When there is clinical evidence of its involvement, as demonstrated by ocular edema, interference with ocular movement, impairment of vision, pain in the eye, or lacrimation.
2. When the cancer has broken through the superior or posterior wall of the antrum or there is evidence of erosion of the superior antral wall as demonstrated by roentgenograms.
3. When the cancer has involved the ethmoid sinus or the middle turbinate, as demonstrated by nasopharyngoscopy.
4. When anaplastic cancer is growing on the superior wall of the antrum, even though erosion has not yet occurred and even though it appears to be confined to the antrum. In these circumstances, a large orbital aperture is useful for the effective direct application of external irradiation to the bed of the maxilla.

The eye was removed at operation in seven of the surgical cases in this series, usually within the last years of the study; one of these patients survived (see Fig. 3). It was necessary to remove it after operation in two other cases, in which extensive involvement occurred.

When the decision to remove the eye is not made until operation, it can be made either when the orbital periosteum is reflected off the superior surface of the zygomatic bone and the superior wall of the maxilla or when the ethmoid cells are sectioned.

When the decision is made before surgery, *en bloc* remov-

al is done (see Figs. 9-B, 22-B). The incision is the same as for maxillectomy without removal of the orbit except that a double-limbed incision is made about the lid margins (see Fig. 11). The incision is kept as close as possible to the palpebral border. The tissue in the upper lid is undermined and the skin is reflected upward to the superior bony rim of the orbit.

The operative procedure is more extensive than in simple removal of the maxilla. A greater portion of the zygomatic bone is removed. The frontosphenoid process is transected with the Gigli saw from the inferior orbital fissure through its temporal border. The zygomatic arch is sectioned at its articulation with the temporal bone. The periosteum is reflected downward and posteriorly from the superior orbital wall to the optic foramen.

Heavy curved scissors are introduced to section the optic nerve, with its associated muscles and vessels, at the depth of the orbital cavity. This technique permits removal of the orbital contents with the maxillary mass.

Mobilization of the maxilla is carried out by the technique already described, except that the superomesial attachment of the bone (in the region of the attachment of the middle turbinate and themoid cells) is separated as close to the cribriform plate as possible. If openings in the plate occur during this maneuver, with loss of cerebrospinal fluid, they can be readily closed by the application of a skin graft, with a muscle supplement if necessary, secured from a local normal area. The graft is applied to the skin of the upper lid, which is turned back into the orbital defect and sutured to the graft. Packing inserted into the defect holds both the graft and the skin of the upper lid firmly against the underlying bone. The graft usually adheres readily to the bony walls of the orbital cavity. The margin of the lower eyelid is turned inward upon itself for a few millimeters, to ensure added thickness, and then is sutured to the skin graft underlying the cheek flap.

Although the orbital aperture left after the use of this technique is somewhat wider than normal, this is an ad-

vantage in the advanced cases in which it is necessary. It permits visualization of the surgical field, to determine whether recovery is proceeding favorably or recurrence is developing, and also affords access for application of radium to the underlying tissues or for the direct application of external irradiation.

Preoperative and Postoperative Management. Since surgery for maxillary cancer is frequently performed on older persons, it is particularly important that preoperative preparation include a general physical examination, to eliminate distant metastases and to determine the status of the respiratory, cardiovascular and renal systems. The investigation should include roentgenograms of the chest, an electrocardiogram, and blood chemical determinations. Local cleanliness is essential. If nasal hemorrhage has been serious, blood transfusion is usually necessary. In any event, preparations should be made to transfuse all patients during operation as well as afterward. Penicillin is begun by the intramuscular route 24 hours before operation.

The packing inserted at operation is left in place for a week. It is then removed and replaced with a similar pack. Additional replacements are inserted every four or five days. Scrupulous cleanliness of the operative cavity must be maintained until healing is complete. It is accomplished by suction and with irrigations of water and the use on applicators of H_2O_2 in solution or in full strength.

There is no reason why a patient who has undergone surgery for cancer of the antrum should not be out of bed within 24 hours. Prolonged bed rest, particularly in older persons, is an encouragement to stasis pneumonia and to other pulmonary and upper respiratory complications.

A feeding tube is used for three or four days after operation, to maintain nutrition until swallowing is re-established. A soft diet is instituted as soon as the tube is removed, and normal diet as soon thereafter as it can be taken comfortably. If hard foods are taken too early, they will shove the pack up and cause considerable discomfort.

About the fourth week, a soft foam-rubber insert is cut to

fit the palatal defect and is worn as a temporary prosthesis. The patient can be shown how to change and clean it, as well as how to irrigate the cavity. Within four to six weeks after operation, a permanent dental prosthesis can usually be tolerated (see Figs. 10-C, 4-C). It covers the palatal defect and is worn as an upper plate.

MANAGEMENT OF CERVICAL METASTASES.

The management of metastases cervical lymph nodes introduces a number of problems. When they are present, the prognosis is obviously less good, but that fact, unless there are other contraindications, should not influence the surgeon against operating.

The first step is to determine that the nodes are metastatic, as should be the presumption; or infectious, which, in the face of the primary malignancy, is not very likely. In at least two cases in my own series this mistaken assumption was made in lymph nodes present when the patient was first seen (see Fig. 2-A).

If the enlarged lymph nodes are present at the time of the first operation, radical neck dissection should be carried out at the same time as the radical antrum operation. This procedure can be performed safely, as I have recently demonstrated, in a case not included in this series. The retropharyngeal lymph nodes are, of course, not accessible to surgery, and if they are involved, irradiation is necessary to control them.

If the lymph nodes become enlarged after the primary operation, again it must be presumed, until it is proved otherwise, that the enlargement is due to metastases. If the differentiation cannot be made clinically, aspiration biopsy may be useful, as it was, for confirmatory purposes, in one case in this series. Grossman and his associates⁴ point out the danger, if formal biopsy is employed, of creating a haphazard lymphatic circulation which may conduct metastatic emboli to inaccessible areas rather than to the readily recognizable nodal barriers in the neck.

Lymph nodes which become involved after primary sur-

gery are best managed by radical neck dissection, with removal of all lymph-bearing structures. This procedure is best even if irradiation has been previously employed. I do not regard irradiation as an effective means of control. The experience of Larsson and Mårtensson⁹ corroborates this position. Their five-year cures in cases of lymph node metastases were seven per cent, against 29 per cent in cases without them, but when the nodes were managed by excision in 10 of 14 patients who presented them, five of the 10 were symptom-free at the end of five years.

Six of the seven patients in my series who had involvement of the cervical nodes when they were first seen died promptly, and the seventh patient had uncontrolled cancer when he was last observed. Radical neck dissection in two of these cases failed to halt the malignant progression.

IRRADIATION.

The disadvantages and uncertain results of primary irradiation in carcinoma of the antrum have already been discussed. As Frazell²³ says, irradiation, in its hey-day, was chosen by default rather than on the basis of the proved superiority of its results. It never satisfied the objectives of being less radical than surgery and circumventing the obvious disadvantages of surgery. The principles, as stated by Lenz,²⁴ are to administer treatment while the growth is accessible, is limited in extent, has not invaded cartilage or bone, and has not metastasized. The mere statement of these principles, which are totally unattainable, is, in itself, an argument against the sole use of irradiation. The complications of irradiation, as Watson¹ says, are particularly trying in the management of an elderly patient already overtaxed by pain and pre-existing sepsis, and this situation is still another argument against primary irradiation.

Routine irradiation is not required after surgery. There should be a selection of cases. Unless the growth is anaplastic, it can be omitted when an experienced surgeon believes that he has removed all malignant tissue. Irradiation should be employed in all cases in which there is doubt that total removal has been accomplished, and in all anaplastic

tumors. It should be applied in full dosage, from four to six weeks after healing of the skin flap is complete.

When the orbit has been removed with the antrum, irradiation can be delivered through the orbital as well as through the palatal defect, to provide more portals for administration and to reduce the possibility of uneven distribution. The method of intracavity radiation devised by Raines and James³⁵ overcomes the limitations associated with even the most competently applied external high voltage irradiation. Their technique, which has been made possible by the advent of radioactive cobalt, gold and iridium, involves the implantation of radioactive seeds in a dental mold, in such a manner that the seeds come into contact with the actual or suspected areas of residual malignancy on the walls of the surgical defect. A tumor dosage of 7,000r is used. This method, which is quite recent, was not used in any instance in my series.

Before irradiation is undertaken, all carious and septic teeth should be removed. Del Regato,³⁶ in his own series, was able to trace a serious infection in one case to failure to observe this precaution. Edema of the glottis should be watched for, and emergency tracheotomy should be performed if it is indicated. Pneumonia is sometimes a complication; it should be promptly treated by the proper antibiotic therapy. Routine blood counts should be performed, and transfusions given on the usual indications. When the eye has not been removed, trichiasis is frequently troublesome, and atrophy of the salivary and lacrimal glands is likely to be permanent. Glaucoma and ulceration frequently require enucleation.

An occasional observer believes that the most effective form of combined therapy is irradiation followed by surgery within four to six weeks, after the reaction has subsided. As a rule, those who advocate this policy still seem somewhat hopeful that surgery may possibly become unnecessary. I do not share their opinion. An additional argument against this sequence is that when surgery is undertaken after irradiation, the tissues have frequently been so altered that the status and extent of the growth may be difficult if not impossible to determine.

No matter what technique is used, irradiation should be undertaken only in cooperation with a competent radiotherapist, who assumes full responsibility for dosage and technique. He is preferably present at the operation; if this is impossible, he is fully informed on all details of the case. Both he and the surgeon should be jointly responsible for the follow-up.

PROGNOSIS AND RESULTS.

The outlook in cancer of the antrum is frankly gloomy. In 1937, in their study of life expectancy and incidence of malignant disease, Welch and Nathanson⁸ found that in 106 traced cases, 25 per cent of the patients were dead in 10 months, 50 per cent in 17 months, and 75 per cent in 32 months. The median life expectancy of patients with treated cancer of the antrum was 17 months. Even with the improved therapeutic methods at our disposal today, almost 20 years after this study was published, it is doubtful that the results are very much better.

According to Watson¹ three factors influence the prognosis in cancer of the antrum: 1. the location of the tumor; 2. its type and histologic grade; and 3. the presence or absence of metastases. There is nothing that the surgeon can do about any of these factors.

The size and direction of extension of the growth are of obvious prognostic significance. Invasion through the anterior or inferior walls is not of itself incompatible with cure, but there is little chance of survival with deep extension into the pterygopalatine fossa, along the pharyngeal walls, or into the cribriform plate. The prognosis is also poor in lesions located posteriorly and mesially. When an antral tumor has invaded the oral cavity, its behavior in respect to metastases is that of a primary oral cancer.

Attention has already been called to the difficulty of determining from the literature what the end-results of therapy are in cancer of the antrum. The accompanying table (see Table 1) is highly selective and is presented with considerable hesitation, partly to show how difficult is the collection of data and partly to indicate how poor the collective results

of treatment are in this condition. An attempt to make up the data more specifically, on the basis of treatment in the individual series proved impossible. For one thing, the authors themselves frequently did not make this clear, and for another, the period of this survey covered the period of changing techniques of management.

TABLE I.
Five-Year Results in Recorded Series of Carcinoma of Antrum in Relation to Method of Treatment.

Source	Year of Report	Number of Cases	Number of Survivals	Therapy
Ohngren ²	1937	120*	42	Endothermy and irradiation.
del Regata ³⁶	1937	10	5	X-ray. 1 death after 5 years.
New ¹⁷	1938	236*	127	Surgery and radiation. 50 cases secondary.
Woodward and Archer ¹⁴	1940	14	0	Local surgery and radiation.
Percy ¹¹	1941	45	9	Cauterization. Many previous treatments.
Watson ¹	1942	55*	15	Surgery and irradiation.
Tod ³⁶	1938	222	46	Radium.
Tice and Beller ²¹	1949	25*	8	Surgery and irradiation.
Seelig ⁵	1949	9	1	Surgery and irradiation.
Capps and Williams ³⁹	1950	15*	4	Surgery and irradiation.
Larsson and Mårtensson ⁹	1950	256*	68	Surgery and irradiation.
Schall ³⁷	1951	219*	59	Surgery and irradiation.
Mattick and Streuter ⁷	1951	68	7	Surgery and irradiation.
Cranmer ²⁶	1953	91*	9	Surgery and irradiation.

*Series also includes carcinoma of all sinuses or nasal cavity or both areas in addition to antral malignancy.

The most lucid and valuable of all follow-up reports of cancer of the paranasal sinuses and nasal cavity is by Schall,³⁷ from the Massachusetts Eye and Ear Infirmary and the Tumor Clinic of Massachusetts General Hospital. The series includes 219 patients, all of whom had passed the five-year mark and all but seven of whom were traced. There were 46 five-year survivals in 131 patients treated primarily by surgery or surgery combined with irradiation, 13 survivals in 74 patients treated primarily by irradiation, and no survivals in ten patients treated primarily by radium. The remaining patients had no treatment at all. There was only

one five-year survival in 67 cases in which metastases were present when the patients were first seen.

In Schall's series, all patients who survived three years went on to survive five years without recurrence. He believes, nonetheless, that any results based on less than five-year follow-ups are confusing and unreliable. The point of view is correct, for recurrences are possible not only at five years but long after. Two patients in my own series died after five years, one of them after almost seven-and-one-half years. One of Cranmer's²⁶ patients had a recurrence after 10 years. The situation when recurrence develops is not, of course, always hopeless. In 31 of the surgical cases reported by Larsson and Mårtensson,⁹ further resection was impossible in 19 cases, but of the 12 patients who underwent secondary surgery, one was alive and well at three years and another at five years.

A review of the literature of carcinoma of the antrum is not without its ironic aspects. Of the nine cases reported by Seelig,⁵ for instance, the only survivor was confined to a mental hospital, for suicidal tendencies. He had been well for seven years.

Mattick and Streuter⁷ break their 68 cases down into 52 late cases and 16 early cases. Seven of the patients with early disease survived from three to 13 years, six from seven to 13 years, and nine from two-and-one-half to 13 years. Only five patients with advanced disease survived more than two years, regardless of treatment, and the average survival in this group was only seven months. When the 10-year period of the survey was broken down into five-year periods, the survival rate was found to be 15 per cent in the second period against only six per cent in the first period. Mattick and Streuter believe the explanation of the improvement in the second period is more adequate surgical exposure and drainage, in addition to the use of postoperative irradiation.

Tod²⁸ also breaks down her cases into early and late groups. Of 95 patients with early disease, 29 were alive and well at the end of five years, five were alive with recurrences, and seven had died of intercurrent disease. Of 127 patients with

late disease, 17 were alive and well and three were alive with recurrences at the end of five years.

In my own series, when the cases are broken down according to the treatment employed, the groups become too small to make the figures of any significance, but they are presented for what they are worth.

The eight cases in the group treated only by surgery cover the period 1948-1955 inclusive. There were four deaths. One patient is alive and well at five years and another at five years and three months. The other two patients have just passed the three-year period.

The 25 cases in the group treated only by irradiation cover the period 1941-1954. There were 18 deaths. One patient is alive and well 12 years and three months after treatment; this is the patient with the antral fistula from a gunshot wound who has already been described. There is no reason to believe that any of the six patients upon whom no recent information is available could possibly have survived.

The 20 cases in the group treated by combined surgery and irradiation cover the period from 1940 through 1955, but 13 were treated in the last six months of the study, the number, small as it is, representing the new therapeutic trend. Fifteen patients are known to be dead. Two were dying when last seen, and there is no reason to believe that another, who is untraced, could possibly have survived. The other two patients are alive and well at four years and three months and five years and eight months, respectively.

The seven patients in the fourth group had such advanced disease when they were first seen that only palliative and supportive measures were possible. Five died during the period of observation and the other two were dying when they were last examined.

In other words, of the seven patients out of this group of 60 who are known to be alive and well at this writing, two have passed the third year, one the fourth year, and four the fifth year. The total number of cases is too small to permit conclusions, but when these observations are combined with

the experiences and results of others, it seems fair to say that in this disease, in which the outlook will probably never be anything but gloomy, the best therapeutic results are being achieved with a combination of surgery and postoperative irradiation.

CAUSES OF DEATH.

O'Keefe's¹² analysis of the causes of death in 47 fatal cases of carcinoma of the antrum is typical of what usually happens in this disease. In 37 cases death occurred from extension of the primary and metastatic lesions, complicated by sepsis, pneumonia and other terminal conditions. Six patients died from massive hemorrhage and one from coronary thrombosis. One had refused treatment. Two patients had lived more than five years and died from causes not related to antral malignancy. Eighteen of the 47 patients lived less than three months after hospitalization for the first time, ten for six months, 12 for a year, and five for two years or more.

As these cases show, and as the fatalities in my own series prove, death in carcinoma of the antrum occurs chiefly from local extension of the disease, before metastases become clinically evident, with malignant cachexia and septic absorption, often complicated by aspiration pneumonia, the chief causes. Seelig⁵ correctly points out that death from pulmonary complications is more frequent when the palate is removed, as the nose and mouth then become one continuous cavity. Shock and loss of blood at operation, which were formerly frequent causes of death, should not occur today. Meningitis is also no longer a significant cause of death, but epidural abscess is a fairly frequent terminal complication.

The last stages of carcinoma of the antrum are very distressing, as Tod³⁸ points out, with severe pain, great deformity, and repeated hemorrhages. The terminal state sometimes lasts for many months before local extension kills the patient, who, as she says, is seldom relieved by a more merciful death from metastases. The terrible deaths which many of the patients in my own series suffered—prefrontal lobotomy was being considered in one case to relieve intolerable pain—

provide further proof, if further proof be needed, that almost any risk which radical surgery entails is justified from the humane standpoint of the patient's best interests.

SUMMARY.

Carcinoma of the antrum is an infrequent disease, for which no universally applicable etiologic factor has yet become apparent, though chronic irritation undoubtedly plays a role in some cases.

Most tumors are of the squamous-cell variety, and a large proportion are anaplastic. Because the disease is usually far advanced when the patient is first seen, the precise point of origin is often difficult to determine.

The fairly general belief that this is a localized disease, in which metastases seldom occur, is not warranted by the facts. They are not observed for two reasons—that the patients often die before obvious metastases occur, and that they are not sought for. If autopsy could be secured in every case, the thinking on this point would become quite different.

The most unfortunate consideration in carcinoma of the antrum is the rather general acceptance of the late clinical picture as the classical picture. With care, a story of early, presumably insignificant symptoms can usually be secured. Unless the emphasis is placed upon these early symptoms, and unless physicians develop a higher index of suspicion than now exists in regard to this disease, the results are not likely to be improved.

Diagnosis rests upon clinical examination, roentgenologic examination, and formal biopsy. Aspiration biopsy and cytologic examination are useful adjuncts, but formal biopsy is essential in every case; frozen section is not an acceptable substitute.

The pendulum of management has swung from primary surgery to primary irradiation. Now treatment is based upon primary radical surgery followed, in selected cases, by irradiation. Radical surgery always includes maxillectomy; the orbital contents should be removed or allowed to remain

in situ according to the indication in the particular case. Controlled hypotensive anesthesia is a useful technique in selected cases. The technique and dosage of irradiation therapy are the business of the radiotherapist, but the best results are secured when he and the surgeon work in close cooperation.

The recorded results of carcinoma of the antrum are discouraging, but recently reported series indicate that they are best when treatment consists of radical surgery followed by selective irradiation. Dying in this disease can be so prolonged and terrible that these circumstances must be taken into consideration in evaluating the surgical risk. When a disease is lethal, desperate remedies may be warranted.

This study is based upon an analysis of 60 cases of carcinoma of the antrum collected from three New Orleans hospitals. Three of the 60 patients are alive and well from three years to four years and three months after treatment, and four others are alive and without evidence of recurrence for periods varying from five years to 12 years and three months after treatment. The numbers are too small to be of any statistical significance, but it is clinically significant that six of the seven survivors were treated by surgery, with or without irradiation, and that all four five-year survivors were thus treated.

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AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY HOME STUDY COURSES.

The 1957-1958 Home Study Courses in the basic sciences related to ophthalmology and otolaryngology, which are offered as the American Academy of Ophthalmology and Otolaryngology, will begin September 1 and continue for a period of ten months. Detailed information and application forms can be secured from Dr. William L. Benedict, executive secretary-treasurer of the Academy, 15 Second Street S. W., Rochester, Minn. Registrations should be completed before August 15.

ABNORMAL PATENCY OF THE EUSTACHIAN TUBE: SURGICAL TREATMENT.*†

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Abnormal patency of the Eustachian tube is an unusual, but not a rare, condition which often is unrecognized by the otologist. The significance of the condition is attributable to the reaction of the patient to his symptoms. Moore and Miller aptly stated: "As a rule patients with patulous Eustachian tube are far more disturbed by their symptoms than are those with obstructed tubes. They may be extremely nervous and give one a strong impression of psychoneurosis at first."

The most distressing symptoms are autophony of marked degree and a loud swishing sound synchronous with respirations when breathing through the nose. The symptoms are aggravated by exercise and fatigue, and are relieved by recumbent posture, by placing the head between the knees, and by sharp inhalation movements with mouth and nose closed. True tinnitus is absent, and the hearing usually is not impaired.

Diagnosis is based on a history of the above symptoms and a demonstration of patent Eustachian tube by one or more of several methods. The tympanic membrane often may be seen to move in and out with respirations. Breath sounds and increased vocal resonance are heard in the affected ear by means of the auscultation tube. Perlman¹⁰ described methods for determining the pressure required to open the Eustachian tube during the Valsalva maneuver, and for measuring transmission of sound from a sound source fitted to the nose to a microphone fitted into the external

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auditory canal. Shambaugh made audiograms with the receiver of the audiometer at the open mouth and the external auditory canals plugged. Thresholds are significantly lower when the Eustachian tube is open than when it is closed. Metz described changes in the acoustic impedance of the ear which occur when the Eustachian tube is open.

ANATOMY AND PHYSIOLOGY.

The functions of the Eustachian tube are to ventilate the middle ear, to allow escape of secretions from the middle ear and to provide a protective barrier from the nasopharynx.

The tube is comprised of two portions: a lateral bony canal and a medial membranocartilaginous canal. This presentation is concerned with only the medial portion.

The dominant anatomic structure is the cartilage of the Eustachian tube. The cartilage is described by Aschan as a single cartilage bent in the form of a shepherd's crook to form the medial (inferior) and the lateral (superior) lamellae. The lateral lamella is the same height in all parts of the tube. The medial lamella is three to eight times as high as the lateral lamella. The lateral lamella is widest at its pharyngeal end, and the free edge curves laterally at the tympanic end to change the lumen from a slit to a cylinder.

The cartilage is separated from the lumen by perichondrium, submucosa, and mucosa. The latter layers continue between the free margins to form the inferolateral membranous wall of the tube.

The Eustachian tube is rich in elastic fibers. Guild described elastic fibers in the cartilage, perichondrium, and submucosa. The fibers are concentrated to form a cap over the lumen at the junction of the medial and lateral lamellae, and in the submucosa they are denser in the membranous than in the cartilaginous wall. Guild did not find any line of demarcation between the elastic fibers of the various layers of the tube. He expressed the opinion that the elastic fibers act to close the tube.

The principal muscles associated with the Eustachian tube are the tensor veli palatini, one head of which takes origin

from the free margin of the lateral lamella of cartilage, and the levator veli palatini, which is not attached to the cartilage but passes through a groove in the free margin of the medial lamella. The tensor is innervated by fibers from the fifth cranial nerve which traverse the chorda tympani nerve and otic ganglion, while the levator is innervated by the tenth cranial nerve.^{4,12} Rich¹¹ concluded that the tube is opened by the tensor alone, while Aschan and Zöllner favored the combined action of the tensor and levator. Both authors discounted the effect of the salpingopharyngeus, pharyngopalatinus and constrictor pharyngis superior muscles. Perlman⁹ stated that paralysis of the tensor muscle is a cause of abnormal patency of the Eustachian tube. The tensor veli palatini has no action in elevation of the palate.

ETIOLOGIC ASPECTS.

Emaciation (Bezold), section of the fifth cranial nerve (Perlman⁹), destructive lesions, scarring from adenoidectomy, and Roentgen therapy (Shambaugh) have been credited with causing abnormal patency of the Eustachian tube. In addition the literature contains reports of many cases in which abnormal patency of the Eustachian tube could not be attributed to any definite lesion.

TREATMENT.

Treatment for abnormal patency of the Eustachian tube has been nonsurgical. Persons whose Eustachian tubes open as the result of emaciation benefit from gain in weight. Most patients have discovered means of securing transient relief of the symptoms by lying down, placing the head between the knees, or inspiratory movements with nose and mouth closed. The commonest treatment used by physicians has been application of irritants to the mouth of the Eustachian tube, the preferred method being insufflation of the tubal orifice with powder made up of one part of salicylic acid in four parts of boric acid, as described by Bezold. Shambaugh reported improvement in three of four patients who sniffed a solution of sodium chloride through the nose.

I have not found a report of any surgical treatment for abnormal patency of the Eustachian tube. Halsted in 1926 proposed closure of the pharyngeal end of the tube in certain patients subjected to radical mastoidectomy. He stated that the procedure had been performed by Beck. Metz suggested a minor plastic procedure be done to narrow the pharyngeal orifice of the tube, but he implied the risk of complete closure and did not report having done the operation.

In recent years at the Mayo Clinic surgical treatment of three patients who suffered abnormal patency of the Eustachian tube has been undertaken. One patient (Case 1) was operated upon as the result of an error in diagnosis, another patient (Case 2) was operated on because she could not tolerate treatments to the Eustachian orifice owing to extreme nervousness; and a third patient (Case 3), underwent operation because insufflation of the salicylic-boric acid powder became ineffective after a few months of treatment.

REPORT OF CASES.

Case 1—A girl aged 17 years was first examined at the clinic in 1940. For six months she had experienced tinnitus in the left ear when using a dictaphone. The symptom had been relieved by shrinking the left middle turbinate.

In 1947 she returned to the clinic, and at this time she stated that for six years her left ear had felt plugged as though filled with water. Symptoms were present from 10 a.m. until evening and were relieved by lying down or by bending her head forward. The symptoms impaired her ability to think. Tonsillectomy on two occasions and repeated inflations of the Eustachian tube had failed to relieve the symptoms.

Examination revealed a well-nourished woman of 24 years in good general health. Adhesions were found in each fossa of Rosenmüller. Weber's test was referred to the left ear and a slight reduction in hearing for the tuning fork at 2,048 cycles per second was noted.

On July 29, 1947, she underwent operation under local anesthesia. Adhesions in both fossae of Rosenmüller were broken by finger massage. Each side of the nasopharynx was irradiated with 50 mg. of radium filtered by 1 mm. of brass and 0.5 mm. of silver for a period of one hour. She was dismissed after her recovery from this treatment.

The patient again returned in 1952. Separate statements indicated relief of symptoms for two, six and 12 months after the treatment just described. Recurrence of symptoms of fullness in the ears, autophony, roaring breath sounds, and popping of the ears on blowing the nose had occurred abruptly. She had been treated with histamine and with radium in the intervening period. Examination revealed motion of the left tympanic membrane when the patient produced alternate positive

and negative pressure in the nasopharynx. Adhesions were again observed in the left fossa of Rosenmüller.

A diagnosis was made of an abnormally patent Eustachian tube. Insufflation of the salicylic-boric acid powder gave relief for ten days on each of two occasions.

The patient underwent a second operation under general anesthesia on September 20, 1952. The adhesions were removed by biting forceps



Fig. 1. Removal of adhesions from fossa of Rosenmüller.

under direct vision and nine days later the area of the adhesions appeared to be covered with epithelium (see Fig. 1).

The patient returned in 1953, nine months after the second operation. Relief of symptoms had persisted for eight months, but the adhesions had re-formed. The third operation was performed in the office with local anesthesia. The adhesions were cut with biting forceps, but the patient was not relieved of her symptoms.

The left Eustachian orifice was swabbed with a 2 per cent solution of dionin without relief. She was then taught to insufflate her own Eustachian tube with the salicylic-boric acid powder.

The symptoms of patulous Eustachian tube developed grad-

ually. Adhesions in Rosenmüller's fossa were not reported at the first examination but were noted on the second examination after two operations on the tonsils. The symptoms were relieved on two occasions by separation of adhesions in Rosenmüller's fossa. Relief did not result from the third separation of adhesions. The treatment, supplemented by application of radium, was first undertaken for relief of supposed insufficiency of the Eustachian tube. Ensuing relief of symptoms encouraged repetition of the same procedure after the diagnosis had been changed to patulous Eustachian tube. The temporary relief which followed the first two procedures suggested that in this patient contracture of scar tissue in Rosenmüller's fossa served to hold the Eustachian tube open. Failure to relieve the symptoms the third time may have been the result of failure to separate scar tissue situated deep in the fossa resulting from previous operation, or to progressive deterioration of the structures responsible for closure of the tube.

Case 2—A woman, 25 years of age, was first examined at the clinic on November 24, 1953. In 1947 she had been treated for seborrhea of both external auditory canals with two 2-minute exposures to Roentgen rays each week for six months. In 1949 she had noted a pop or click in the right ear followed by sensations of air rushing into the ear, of sounds similar to blowing over the mouth of a bottle on nasal respirations, and of her own voice being unbearably loud. The symptoms persisted until another click was heard minutes or hours later. The symptoms were relieved by lying down and during head colds. She stated that the symptoms made her so nervous that she "could not go on," and that she refrained from talking when the symptoms were present. Tonsillectomy had been done at 15 years of age, and she had suffered an attack of scarlet fever when she was 16. Previous therapy had consisted of the application of radium to the nasopharynx in two series of three applications each.

Examination revealed a well-nourished young woman in good general health. The mucosa of the nose and nasopharynx was atrophied to a moderate degree. The right tympanic membrane moved on nasal respiration.

The patient was unable to tolerate inflation of the Eustachian tube because of nervousness. Cautery of the torus tubarius with a 50 per cent solution of silver nitrate gave relief for three days, after which the patient was "frantic."

On December 12, 1953, she was operated upon. General anesthesia was used and a flat cautery tip was inserted 0.5 cm. into the right Eustachian orifice. The coagulating current was applied three times with sufficient current each time to cause boiling in the mouth of the tube.

The patient was free of symptoms and felt "just wonderful" for three weeks, after which symptoms recurred gradually. She was still unable to tolerate inflation.

A second operation was carried out on May 8, 1954, with the patient under general anesthesia. The palate was divided at the raphe palati. An incision was made along the rim of the right torus tubarius, and the mucosa was elevated from the cartilage. The tubal mucosa was torn in the process. Approximately 1 cm. of cartilage was removed with ethmoid biting forceps. No cartilage could be palpated at the end of the operation (see Fig. 2).

The incision in the palate healed without incident. One week after operation the patient noted autophony and sense of fullness in the

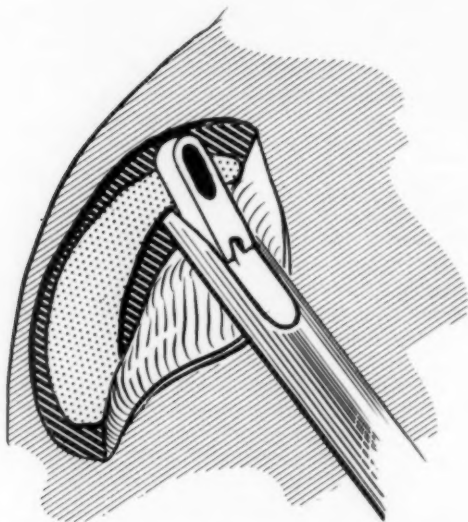


Fig. 2. Removal of cartilage from Eustachian eminence.

right ear. Examination revealed fluid in the middle ear. Symptoms were relieved by aspiration of fluid. At this time blowing the nose resulted in inflation of the unoperated ear but not of the operated ear.

The right middle ear filled with fluid each time the myringotomy incision closed. A polyethylene tube was placed in the myringotomy incision and allowed to remain for six months. After this procedure the perforation remained open, and the ear remained free of symptoms; however, the patient noted autophony in the left ear when pronouncing the letter "S." She was relieved of this symptom by gaining five pounds of weight (see Fig. 3).

The cause of abnormal patency in this patient is presumed to be atrophy of mucosa resulting from repeated irradiation to the external auditory canals. More than a year elapsed

between termination of radiation therapy and onset of symptoms. The symptoms may have been aggravated by further irradiation of the nasopharynx.

The patient is highly pleased with the result of surgical therapy. Nervousness and apprehension have diminished markedly. After operation she tolerated myringotomy with-

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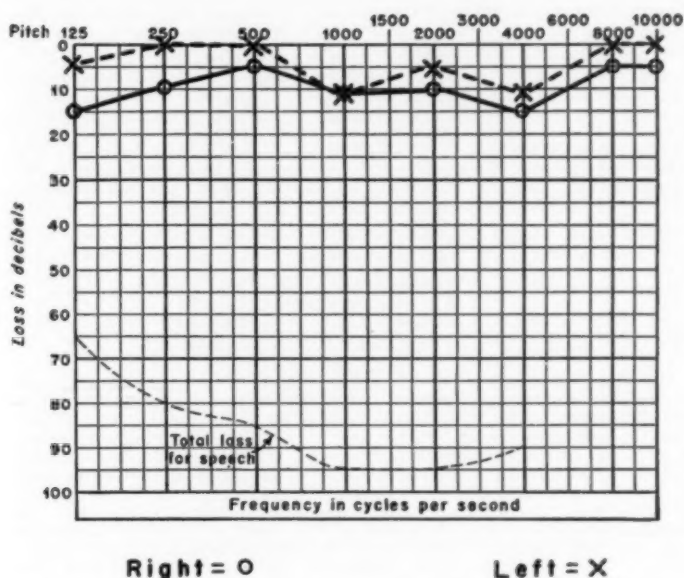


FIG. 3. Air-conduction thresholds after closure of Eustachian tube (Case 2).

out general anesthesia, whereas before operation she had been unable to tolerate intubation of the Eustachian orifice. She is now regularly employed in office work.

Case 3—A 30-year-old woman was first seen at the clinic on August 31, 1955. She complained of symptoms in the left ear, which recurred daily. Soon after rising in the morning she experienced a loud pop in the left ear, followed by a sense of fullness in the ear, snapping on nasal respiration, and autophony. At the onset the symptoms were re-

lieved by placing her head between her knees. This means of relief later failed. She was symptom-free when recumbent. Cotton in the external auditory canal decreased the sensation of snapping. She did not experience a loss of hearing or real tinnitus.

The onset of symptoms followed an attack of polio-encephalitis during pregnancy in December, 1951. Paralysis was noted in the right side of the body and left side of the face. Weakness persisted in the right leg, and fatigue of the left jaw was noted on chewing tough meat. She also cleared her throat frequently because of a sensation of pooling of mucus in the left hypopharynx.

The patient delivered a normal infant in May, 1952. During the next year she suffered two periods of acute depression and was treated by shock therapy. She had continued under psychotherapy until the date of her examination. The patient attributed her emotional disturbance to the ear symptoms, which in turn were attributed by her physicians to the emotional upset.

The examination revealed a young woman 5 feet 2 inches in height and weighing 112 pounds. The left external auditory canal was tightly packed with cotton. The left tympanic membrane moved with respiration, and breath sounds were heard through the auscultation tube placed in the patient's left ear. An audiogram revealed normal hearing. The palate and pharynx moved normally. Excess mucus was not seen in the hypopharynx. The bite was weak on the left side; the left masseter and pterygoid muscles were diminished in size.

Insufflation of the left Eustachian orifice with salicylic-boric acid powder gave four days' relief of symptoms. The patient's husband was trained to insufflate the Eustachian tube and was given a supply of powder made up of one part salicylic acid in nine parts boric acid.

The patient returned February 1, 1956. Insufflation was required daily to maintain freedom from symptoms. Two episodes of acute suppurative otitis media had occurred. Surgical therapy was planned.

Operation was performed on February 2, 1956. Cocaine was applied to the pharynx and nasopharynx. An electromyogram was made. Active and bilaterally equal responses resulted when the needle was placed into the anterior tonsillar pillars and into each side of the soft palate midway between the tonsillar pillar and the median raphe. Distant activity was recorded when the needle was placed in the posterior wall of the nasopharynx near the Eustachian eminence. Location of the electrode was not precise anatomically, and it seems likely that the impulses recorded were derived from the tenth nerve. General anesthesia was then induced. The palate was retracted to expose the Eustachian orifice. A No. 11 Bard-Parker blade was inserted into the Eustachian orifice until the bony canal was palpated with the tip of the blade. A single incision was made at the 11 o'clock position traversing the tubal mucosa and the cartilage, but not the mucosa of the nasopharynx (see Fig. 4).

After the operation bloody fluid was observed in the left tympanic cavity. Symptoms recurred ten days after the operation.

A second operation was performed on April 5, 1956, with the patient under general anesthesia. The palate was retracted, and a blunt septum elevator was placed in the mouth of the left Eustachian tube as a guide. The rim of the torus tubarius was incised, the mucosa separated from the cartilage, and the medial portion of the cartilage removed for a distance of 7 to 8 mm. Myringotomy was done with crossed incisions and a 2-mm. flanged tube of polyethylene was inserted into the tympanic cavity in anticipation of complete stenosis of the tube.

Symptoms recurred 24 days after operation and a third operation was carried out on May 8, 1956, with the patient again under general anesthesia. The palate was retracted, and the left torus tubarius was found to be flattened. The mouth of the Eustachian tube was not identified. The region assumed to be the mouth of the tube was electrocoagulated, and three mattress sutures of No. 00 plain catgut were placed to invaginate the coagulated area. Argyrol placed in the external auditory canal did not appear in the nasopharynx after massage



Fig. 4. Incision traversing tubal mucosa and cartilage.

of the concha. The symptoms were not controlled. Four days later the plastic tube was observed to be adherent to the external surface of the tympanic membrane at the site of myringotomy. After myringotomy argyrol placed in the external auditory canal appeared in the nasopharynx after inspiratory movements with the nose and mouth closed.

At a fourth operation on June 19, 1956, general anesthesia was used, and the palate was divided at midline to the left of the uvula and retracted. The Eustachian orifice was visualized; it was round, open and 3 mm. in diameter. Triangular myringotomy with the base toward the tympanic ring was done, and a solution of argyrol passed through from the external auditory canal for identification. A cone of mucosa and another segment of cartilage were removed from the Eustachian orifice. Three mattress sutures of No. 00 plain catgut were placed to close the orifice (see Fig. 5). After closure argyrol could not be forced from the external auditory canal to the nasopharynx.

The palate healed without incident and with less discomfort and

edema than had resulted from strong retraction at previous operations. The Eustachian tube has remained closed to the present date. The plastic tube became blocked on two occasions causing symptoms due to collection of fluid in the tympanic cavity.

Four months after the last procedure the patient was successfully caring for her home and two children with help one day each week, whereas during the preceding two years she

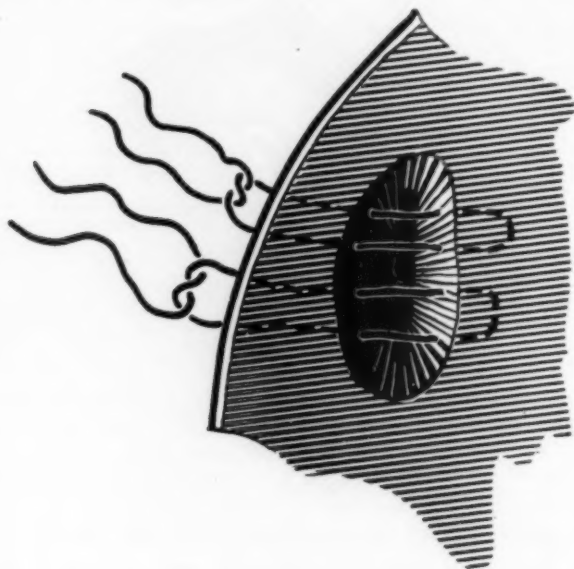


Fig. 5. Conization and suture of Eustachian orifice after removal of cartilage.

had been unable to keep up with these duties with help four days per week.

COMMENT.

The mechanism of passive closure of the Eustachian tube has not been answered fully by my review of the literature and by observations on these and other patients. It seems probable that several factors are involved, among which are pressure of surrounding tissues, action of the elastic fibers

of the tube, and passive action of the tensor veli palatini muscle.

Theoretically, abnormal patency of the Eustachian tube can occur from negative or positive factors.

Possible negative factors which have support in clinical evidence are loss of tissue around the mouth of the tube owing to emaciation or to irradiation therapy and loss of tonic action of the tensor veli palatini muscle. Decrease in the elastic properties of the elastic fibers in the wall of the tube has not been demonstrated, but may be a factor in those cases in which no other cause is evident. Histologic studies of material from patients who have patulous Eustachian tubes might shed light on this point.

A positive factor is excess scarring in the nasopharynx owing to surgical procedures, inflammation, or irradiation therapy. Case 1, reported in this paper, illustrates this group. This factor appears to be a potential hazard after extensive removal of lymphoid tissue and mucosa from Rosenmüller's fossa.

The ideal result of surgical therapy of a patent Eustachian tube is restoration of normal function of the tube. Such function was achieved for a limited period in the first patient (Case 1) in whom the cause of patency was positive; however, it failed in the other two patients (Cases 2 and 3), in whom negative causes prevailed.

If positive etiologic factors are present, release of the abnormal traction which holds the tube open is required. Long-term relief imposes a second requirement, that of prevention of re-formation of scar tissue. In addition to separating the adhesions an epithelial cover must be provided for surfaces exposed by the operation. This is possible but, technically, it is difficult to achieve in an area as inaccessible as the nasopharynx.

Negative factors pose a greater problem. We have not yet learned to restore atrophied tissue or nonfunctioning nervous or elastic tissue by surgical means.

In two of the three cases reported, symptoms resulted from

negative causes. Three distinct surgical procedures were directed toward restoration of normal function: 1. electrocoagulation of the lumen of the tube (Case 2); 2. incision of the cartilage at junction of medial and lateral lamellae (Case 3), and 3. removal of cartilage from the pharyngeal end of the tube (Cases 2 and 3). None was successful.

Electrocoagulation of the lumen of the tube failed to achieve narrowing of the lumen, probably owing to action of the cartilage holding the tube open.

The incision was made from the lumen of the tube and across the mucosa, submucosa, perichondrium and cartilage. Thus it divided the densest concentration of elastic fibers as well as the cartilage. This should result in two opposed effects: 1. breaking the spring of the cartilage and thus allowing the superolateral wall of the canal to collapse into the lumen, and 2. reducing the effective pull of the elastic fibers in closing the lumen of the tube.

Removal of cartilage resulted in complete stenosis in Case 2 and no relief of symptoms in Case 3. Separation of soft tissues from cartilage was difficult in both patients with resultant maceration of mucosa. Dissection was undoubtedly made more difficult by previous therapy with irritating powder, irradiation, cautery, and operation. The arrangement of the elastic fibers, which Guild observed to form a continuous network from cartilage to submucosa, also may interfere with clean separation of perichondrium from cartilage.

It is my opinion that these procedures have no merit, and should be abandoned. In their stead I suggest that the two following procedures be evaluated: 1. incision of the cartilage at the junction of the medial and lateral lamellae, the incision to be made from the nasopharyngeal aspect in order to preserve the integrity of the elastic fiber network while breaking the spring of the cartilage (see Fig. 6), and 2. excision of a V-shaped wedge of cartilage from the junction of the medial and lateral lamellae, preserving the elastic fibers and the attachment of the tensor muscle to the free edge of the lateral lamella. The cut edges of cartilage should be ap-

proximated by sutures (see Fig. 7). This procedure should narrow the lumen of the tube, although alteration in the direction of pull of the tensor muscle might maintain the excess patency of the tube.

Aschan noted that the "safety tube" of Reidinger, situated in the bony portion of the Eustachian tube, failed to open on



Fig. 6. Incision traversing nasopharyngeal mucosa and cartilage.

swallowing, in cases of previous radical mastoidectomy. He attributed this to section of the chorda tympani nerve. This suggests an approach to the problem by section of the chorda; however, the effect of paresis of the fifth cranial nerve in causing abnormal patency obviates this procedure.

Irradiation is contraindicated on theoretical grounds and, in addition, it failed to relieve the symptoms of two of three patients.

In the event that the ideal outcome of restored normal function is not attained, gratifying relief of symptoms can be achieved by permanent closure of the Eustachian tube. This result was achieved inadvertently, in Case 2, and pur-

posely in Case 3. Conization and suture of the pharyngeal orifice of the Eustachian tube is a practical method of achieving complete closure of the tube. Closure is facilitated by removal of a segment of cartilage. Provision of a permanent opening in the tympanic membrane for escape of secretions has proved to be more difficult. I have used flanged



Fig. 7. Excision of wedge from Eustachian cartilage.

tubes of polyethylene as proposed by Armstrong. Permanent stoma did not result until the tube had been left in place for several months.

In this report I have not presumed to present the complete story of the surgical treatment of the abnormally patent Eustachian tube. The ideal result has not been achieved in any patient. I was encouraged to report this meager experience by the extreme gratitude of two patients in whom

the results of treatment fell short of the ideal. The experience of watching the transformation of two nervous cripples into happy, productive young women has, indeed, been gratifying.

Since the meeting at which this paper was presented, a fourth patient has been operated on for this condition at the clinic. General anesthesia was induced and the palate was

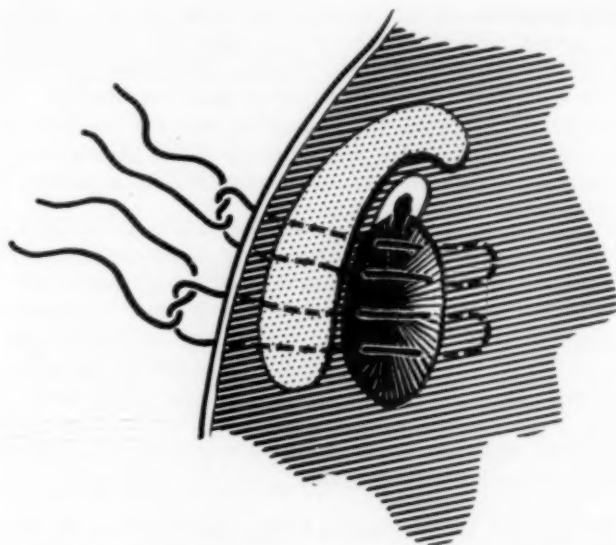


Fig. 8. Partial conization and suture without removal of cartilage.

divided at the midline and retracted. Poor exposure was obtained, owing to the configuration of the nasopharynx, and excision of a wedge of cartilage was impractical. An incomplete cone of mucosa was removed from the tubal orifice without removal of cartilage and the margins were drawn together with mattress sutures (see Fig. 8). The result of the operation was closure of the inferior two-thirds of the Eustachian orifice. Symptoms of abnormal patency were relieved. Myringotomy was done, and a flanged tube of

polyethylene placed in the middle ear at the time of operation. The myringotomy remained open at last report, so that the ability of the Eustachian tube to ventilate and drain the middle ear is unknown. The myringotomy stoma will be covered with a paper disk to test the function of the Eustachian tube.

SUMMARY AND CONCLUSIONS.

The symptoms of this unusual, although not rare, condition of abnormal patency of the Eustachian tube, which often is not recognized by otologists, include autophony of marked degree and a loud swishing sound on nasal respiration. True tinnitus and impairment of hearing are not present as a rule. Diagnosis is made on the basis of the presence of the common symptoms and on demonstration of a patent Eustachian tube.

The cases of three patients having abnormal patency of the Eustachian tube and treated by surgical means are reported, and a fourth and most recent case is mentioned briefly. Although the desired ideal result of restoration of normal function has not been attained, gratifying relief of symptoms followed complete closure of the pharyngeal end of the Eustachian tube in two cases. Creation of a permanent stoma in the tympanic membrane is necessary following closure of the Eustachian tube.

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**SOUTH CAROLINA SOCIETY OF O. & O.-L., AND
NORTH CAROLINA E. E. N. & T. SOCIETY
JOINT MEETING.**

The joint annual meeting of the South Carolina Society of Ophthalmology and Otolaryngology and the North Carolina Eye, Ear, Nose, and Throat Society will be held in Hendersonville, N. C. The dates are September 15, 16, 17, 18, 1957. Headquarters will be the Skyland Hotel. The following guests ophthalmologists will be on the program:

Dr. E. A. Naumenee of Baltimore, Md.; Dr. P. G. Leinfelder of Iowa City, Iowa; and Dr. Alston Callahan of Birmingham, Ala. Likewise the following otolaryngologists will be on the program:

Dr. Francis LeJeune of New Orleans, La., and Dr. J. W. McLaurin of Baton Rouge, La. The third otolaryngologist will be announced shortly.

Hendersonville, N. C., is located in the Blue Ridge Mountains, and is a particularly lovely spot at this season of the year. A large attendance is anticipated. For further information write Dr. Roderick MacDonald, Secy.-Treas., 330 East Main St., Rock Hill, S. C.

SURGICAL MANAGEMENT OF LARYNGEAL
DISORDERS BY THE LARYNGOFISSURE
APPROACH.*†

BERT DEBORD, M.D.,

Temple, Texas.

Although laryngofissure has become almost synonymous in the minds of otolaryngologists, with the removal of cordal cancer by thyrotomy, this approach provides excellent exposure of the interior of the larynx for the surgical management of various laryngeal disorders. It is interesting to note that the first recorded laryngofissure was performed by Desault¹ for the removal of an impacted foreign body of the larynx, and that Withers and others² employed the laryngofissure technique for removal of an impacted foreign body of the larynx during March, 1955. The value of laryngofissure for cordal cancer has already been established, and the technique for the laryngofissure operation has been described adequately in the textbooks of otolaryngology. In this institution, this approach has been used 41 times during the past ten years.

We recommend the use of a motor-driven circular saw (dental type) to split the thyroid cartilage when this structure cannot be incised with a knife or turbinotome. LeJeune and Lynch³ have reported that a motor-driven saw produces excessive heat, and that it may injure the thyroid cartilage. They consider the motor-driven or electrical saw responsible for several instances of sequestration in their series. In our practice, we use continuous irrigation while the cartilage is being incised, and sequestration has not occurred. We do believe, however, that it is possible for the thyroid cartilage to be damaged by electrocautery; therefore, subperichondrial dissection of the vocal cord is performed prior to its

*Read at the meeting of the Southern Section American Laryngological, Rhinological and Otolological Society, Inc., New Orleans, La., January 16, 1957.

†From the Department of Otolaryngology of the Scott and White Clinic.
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removal with electrocautery. Care should be taken to avoid contact with the thyroid ala.

When employing the laryngofissure technique for the surgical management of cordal cancer, the ideal candidate is one who has an early low-grade cancer limited to the anterior half of the true vocal cord with normal mobility of the cord. The degree of extension and infiltration, and the grade of malignancy are the most helpful guides for determining the

TABLE I.
LARYNGOFISSURE APPROACH.
Scott and White Clinic—1946-1956.

	Number of Operations
Cordal Cancer	28
Benign Tumor	3
Ventricular Cyst	2
Arytenoidectomy	8
TOTAL	41

surgical management. The highly anaplastic lesion is likely to extend posteriorly and impair the mobility of the vocal cord by involvement of the cricoarytenoid joint; and when this occurs, the laryngofissure approach usually is contra-indicated. Figi,⁴ however, has been utilizing the laryngofissure approach for performing a hemilaryngectomy. By using a skin graft maintained by a temporary stent in the larynx, he has been able to avoid laryngectomy in certain selected patients with involvement that heretofore was considered too extensive for laryngofissure. Occasionally, one is confronted with an epithelioma of the larynx which is apparently of multicentric origin, as different grades of cancer may be present in the same vocal cord. Carcinoma *in situ* is not uncommon, and it may be contained in a small area, or the lesion may be quite extensive.

At times, benign tumors are of such size, or have become so extensive, that they can be excised more satisfactorily through the laryngofissure incision. Three such tumors have been encountered in our series.

The laryngofissure approach was used for the surgical management of two cysts in the ventricular area of the larynx. In both instances, the cysts were of sufficient size to produce hoarseness and dyspnea. Laff⁶ reported the successful removal of two ventricular cysts by thyrotomy. The origin of these cysts is not explained clearly, but it is generally thought that they are due to disturbances in the development of the larynx. They are termed congenital cysts when they occur in infancy, and according to Halinger and Steinmann⁶ such formations in adults are considered as secondary isolated laryngoceles. According to Jackson and Jackson,⁷ a laryngocele is a tumor-like lesion consisting of an anomalous air sac communicating with the laryngeal ventricle that probably represents an evolutionary remnant of the huge air sacs seen in the anthropoid apes.

During the past five years, we have employed the laryngofissure approach for exposure and removal of the arytenoid cartilage in eight patients with bilateral abductor paralysis of the larynx. In 1951, an emergency tracheotomy was performed on a patient with bilateral abductor paralysis of the larynx. When this patient's general condition had improved sufficiently, it was apparent that an operative procedure for the relief of paralytic stenosis would be required if she was to be decanulated. Thornell⁸ had recently reported excellent results of intralaryngeal arytenoidectomy through the Lynch suspension apparatus. Having noted the rapid healing and epithelization following laryngofissure for cordal cancer when the antibiotics were used, we thought that an arytenoidectomy could be more easily and satisfactorily performed through the midline thyrotomy incision; furthermore, by retracting the thyroid alae, excellent exposure of the arytenoid area was possible; dissection and disarticulation could be accomplished more easily; hemostasis could be readily maintained; and, finally, the mucosal incision could be carefully approximated and sutured.

Seven of our eight patients who had arytenoidectomy by the laryngofissure approach were rehabilitated satisfactorily. The one in question was a patient who had cardiac insufficiency and decompensation prior to operation. The

arytenoidectomy was performed when her general condition permitted. She was decanulated and seemed to have an adequate airway before leaving the hospital; however, it was learned that the patient was having "asthma" after she returned home. It was never determined whether she was having cardiac asthma, or whether an inadequate glottic space caused the dyspnea. Now, we believe that the decompensated patient with cardiac insufficiency can be handled best by tracheostomy and the use of a bivalve tracheostomy tube.

Perhaps the majority of laryngologists use the extralaryngeal approach to arytenoidectomy, utilizing the King operation, or use one of its modifications as described by Woodman.⁹ These procedures have stood the test of time. It seems reasonably certain, however, that good results may be obtained by the intralaryngeal approach; and those who may hesitate to perform an arytenoidectomy through the Lynch suspension apparatus may be justified in utilizing the laryngofissure technique. Antibiotics have reduced the incidence of infection and cicatrization that hampered the pioneers in laryngeal surgery, so that now a number of laryngeal disorders in addition to cordal cancer may be surgically managed by the laryngofissure approach.

Although our present report contains a relatively small number of cases, we believe, as St. Clair Thomson¹⁰ must have believed, when he read a paper on laryngofissure in 1912 before the Medical Society of London and stated: "I cannot submit the results of more than ten cases. But our records will continue to deal with comparatively small numbers until the public and the profession realize the importance of early diagnosis of every case of persistent hoarseness. . ."

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STORZ INSTRUMENT COMPANY ENLARGES NEW YORK CITY SALES OFFICE.

The staff of the long established New York Sales Office of the Storz Instrument Co., at 809 Lexington Ave., has been increased. Gil Weatherly, Manager, is now assisted by Carl Gengo, Andy Scott and Mrs. Nola Golembeski. This office maintains a display of all Storz instruments, including newly developed and uncatalogued items. In addition, all items of equipment are available for demonstration and comparison. For the convenience of Central and South American surgeons, a Spanish speaking member of the staff is in the office at all times.

The growing Storz sales organization includes Tom Morgan, Van Nuys, Calif., Fred Watson, Kansas City, Mo., and Dick Lawrance, Atlanta, Ga. As in the past, all customer correspondence should be directed to the main office and factory in St. Louis, attention J. Herman Belz, Sales Manager, or Eric Storz, Vice-President and Manager.

CONFIRMATION OF NORMAL DISCRIMINATION LOSS FOR SPEECH ON C. I. D. AUDITORY TEST W-22.*†

JOHN F. CORSO, Ph. D.,
University Park, Pa.

INTRODUCTION.

It is now generally recognized that a person's sensitivity to pure tones provides only a limited amount of information about the characteristics of his auditory and perceptual systems; consequently, an increasing emphasis has been placed on the development of tests to measure directly a person's ability to hear and to discriminate among the sounds of everyday speech.⁵ There are, however, many variables which may affect a person's articulation score on a given test, *e.g.*, the kind of speech material used in the test,⁵ the sound pressure level at which the test material is presented,⁶ the distortion properties of the communication system over which the test material is transmitted⁷, etc.; thus, if measures of speech intelligibility are to be applied meaningfully and interpreted in practical clinical situations, it appears that some degree of standardization in methodology must be established.

STATEMENT OF THE PROBLEM.

One test, developed to measure the discrimination loss for speech‡ is the Central Institute for the Deaf (C. I. D.) Auditory Test W-22. For 15 experienced listeners tested on W-22 at a sound pressure level of 60 db re 0.0002 dyne/cm², the average maximum articulation score was 98.9 per cent,³ yielding an average discrimination loss of 1.1 per cent. The

*This research was supported by the United States Air Force under Contract No. AF 33(616)2626, monitored by the Bio-Acoustics Branch, Aero-Medical Laboratory, Wright-Patterson Air Force Base, Ohio. The opinions and conclusions contained in this report are those of the author. They are not to be construed as reflecting the views or endorsements of the Department of the Air Force.

†Department of Psychology, The Pennsylvania State University, University Park, Pa.

‡Discrimination loss for speech is a clinical term which refers to the difference between 100 per cent and the maximum percentage of given speech material that a listener reports correctly at a sound pressure level, beyond which no further increase in intelligibility is obtained.

purpose of the present study is to determine the discrimination loss for speech on C. I. D. Auditory Test W-22 using a large group of untrained listeners with normal ears in order to provide data which may be of significance in the standardization of tests of speech reception.

TEST MATERIAL AND APPARATUS.

C. I. D. Auditory Test W-22* consists of 200 monosyllabic words, divided into four lists of 50 words each. Each of these lists has been "phonetically-balanced" (PB) so that it contains the various English speech sounds in the same relative frequency of occurrence as found in ordinary conversation.³ In part, the words were selected from the Phonetically-Balanced Word Lists of the Psycho-Acoustic Laboratory, Harvard University.⁴

Each of the four basic lists (Lists 1-4) has been prepared in six different word orders (A-F). Each list is introduced by an appropriate phrase, *e.g.*, "This is C. I. D. Auditory Test W-22, List 2E . . . are you ready?" Within each list each test word is preceded by the carrier phrase, "You will say." A 1000-cycle calibration tone has been impressed on the inner band of each W-22 record.

The recorded Test W-22 was played at $33\frac{1}{3}$ rpm. on a Grason-Stadler speech audiometer, Model 1160-A, equipped with a set of Permoflux PDR-10 earphones. In calibrating the phonograph at 1000 cps, the sound pressure output of the right and left earphones was measured in a National Bureau of Standards coupler 9-A according to standardized procedures.¹

SUBJECTS AND PROCEDURE.

The subjects in this study were members of an introductory course in psychology at The Pennsylvania State University. In all, 139 subjects between the ages of 18 and 24, inclusive, were tested: 73 white males and 66 white females. The sub-

*This test, together with an appropriate set of instructions, is distributed by the Technisonic Studios, 1201 South Brentwood Blvd., St. Louis 17, Mo.

jects were selected on the basis of four criteria: 1. a negative otological history;* 2. a maximal hearing loss of 5 db at 500, 1000, or 2000 cps as measured on an ADC audiometer, Model 50-E2;† 3. a maximal hearing loss of 20 db on C. I. D| Auditory Test W-2; and 4. a life-history of minimal exposure to noise as determined from a standardized questionnaire.

During a five-minute rest period following the threshold for speech test (C. I. D. Auditory Test W-2) for a given subject, the examiner computed the subject's hearing loss for speech for each ear. Since all ears had a hearing loss of 20 db or less (as computed from 20 db re 0.0002 dyne/cm²), the discrimination loss for speech test (W-22) was in all cases conducted at a calibrated sound pressure level of 78 db re 0.0002 dyne/cm².‡

The instructions to the subjects, based directly on the specific instructions supplied in the test records, were as follows:

"I am now going to test your ability to discriminate between spoken words. All the words in this test are one-syllable words. You will hear them all at approximately the same loudness. You are to listen carefully and to record as many words as you can on this answer sheet. For the first test, write the test words that you hear under Column 1. Each test word is preceded by the phrase, 'You will say.' Do not write this phrase; write only the test word given *after* the phrase. Are there any questions? (Pause.) I will test your right (or left) ear first, and then your left (or right) ear. After I have placed the earphones on your head, *do not touch them in any way*. Are you ready to begin? (Pause.)"

At the end of the first test list, the subject was instructed, "I am now going to test your right (or left) ear on another

*The otological examinations were performed by Dr. H. R. Glenn, Director, and Dr. E. E. Krug, Assistant Physician, of the Health Service, The Pennsylvania State University.

†The pure tone test was not administered to 7 male and 13 female subjects due to equipment difficulties; however, since these subjects met the remaining three requirements, they were included in the present study.

‡This value is in close agreement with the recommended sound pressure level of 80 db re 0.0002 dyne/cm² indicated in the test instructions.²

list of words. Write the words you hear this time in the spaces under Column 2." For the second test, a second basic list of words (not a different order of the first list) was presented at the same setting as that for the first list.

When testing for the second list was completed, the subject was instructed, "I will now test your left (or right) ear in the same way that I have just tested your right (or left) ear. Record the words you hear on the next answer sheet under Left (or Right) ear, Column 1." Testing on the second list for the left (or right) ear was similar to that for the right (or left) ear, second list. All tests were conducted in an anechoic chamber furnished with a two-way intercommunication system.²

TABLE I.
MEAN VALUES AND STANDARD DEVIATIONS FOR C. I. D.
AUDITORY TEST W-22.

Ear	Number	Mean Discrimination Loss For Speech In Per Cent	Standard Deviation In Per Cent
Right	139	2.26	1.68
Left	139	2.37	1.91
Combined	278	2.32	1.80

RESULTS AND CONCLUSIONS.

To compute the discrimination loss for speech for a given ear on each subject, the total number of words correctly heard from the two W-22 PB lists (50 words per list) was determined and expressed in per cent. The percentage words correct (maximum PB score, "PB Max.") was then subtracted from 100 per cent to obtain the individual's discrimination loss of speech for the given ear. A mean percentage for each ear was then computed for the total sample.

Table I contains a summary of the discrimination loss for speech data for the 139 subjects monaurally tested in the anechoic chamber. For the right and left ears combined ($N=278$), the mean discrimination loss is 2.32 per cent, with a standard deviation of 1.80 per cent.

The values in Table I are in close agreement with the

C. I. D. data for 15 highly experienced listeners, all of whom were thoroughly familiar with the test words and testing situation. For the C. I. D. subjects, the mean PB score reached its maximum at 60 db re 0.0002 dyne/cm² with a value of 98.9 per cent,³ yielding a mean discrimination loss for speech of 1.1 per cent; thus, the data of the present study (2.32 per cent) and the data obtained at C. I. D. (1.1 per cent) are discrepant by approximately only 1 per cent (one word in one hundred), despite differences in listener experience and testing situation. It appears, therefore, that the data of the present study may be taken to represent adequately the discrimination loss for speech for normal, untrained ears when tested on C. I. D. Auditory Test W-22.

SUMMARY.

The present study was undertaken to determine the discrimination loss for speech for normal ears on C. I. D. Auditory Test W-22. Data were collected on both right and left ears of 139 subjects, ages 18-24 years, inclusive, showing negative otological findings, a maximal pure tone loss of 5 db at 500, 1000, or 2000 cps, a maximal hearing loss of 20 db on C. I. D. Auditory Test W-2, and a history of minimal noise exposure. The obtained mean discrimination loss for speech, for all ears combined, was 2.32 per cent with a standard deviation of 1.80 per cent. These results, for untrained listeners, are in close agreement with the normal value of discrimination loss for speech as previously reported³ for experienced listeners on C. I. D. Auditory Test W-22.

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LECTURES AT YALE UNIVERSITY SCHOOL OF MEDICINE.

Otolaryngologists and all other interested doctors are invited to a series of lectures at the Yale University School of Medicine, New Haven, Conn., on May 11 and 12, 1957. These lectures are part of the Postgraduate Course in Reconstructive Surgery of the Nasal Septum and External Pyramid being presented jointly by the Yale School of Medicine and the American Rhinologic Society under the Guest Directorship of Dr. Maurice E. Cottle, Professor and Head of Department of Otolaryngology, Chicago Medical School, Chicago, Ill.

All lectures will be given at the Grace-New Haven Community Hospital, 789 Howard Ave., New Haven, Conn., and will be open to interested physicians without charge.

REHABILITATION OF THE NERVE DEAF PATIENT:
THE BINAURAL-TIME-DELAY STIMULUS.*

W. P. ANTHONY, M.D.,
and
DONALD C. GASAWAY, M.A.,
Forth Worth, Texas.
(By Invitation)

The majority of people with hearing problems turn first to the medical profession for help. Most expect a medical or surgical miracle and a few get, in effect, a miracle; if they happen to have otosclerosis, a central perforation with a mobile ossicular chain behind it, or a serous effusion which does not recur.

The majority are evaluated and found to fall into that vast category known loosely as nerve deafness. These patients need all the help we can possibly afford, for with few exceptions, definitive medical or surgical help is not forthcoming. Without proper guidance and training, the patient faces social ostracism and occupational handicap. It is of utmost importance that we take time to counsel, encourage and guide them into the proper hands for rehabilitation. Those with hearing loss of any degree of severity will need lip-reading. The adult with recent hearing loss will require speech conservation to prevent deterioration of existing speech patterns. The child with congenitally defective hearing will require not only lip-reading, but also must learn speech from scratch and must have auditory training to exploit what small degree of residual hearing might be present.

The elderly with presbycusis need lip-reading, auditory training, and frequently, amplification. The otologist can suggest or reject the use of a hearing aid, depending upon the age of the patient, degree of his general infirmity and

*Read at the meeting of the Southern Section, American Laryngological, Rhinological and Otological Society, Inc., New Orleans, La., Jan. 16, 1957.

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adaptability; also tolerance of the ear for amplified sound. Most important is the ability of the ear to discriminate, or unscramble complex sound, so to speak. A patient who discriminates very poorly gets only amplified confusion from a hearing aid and will not wear it.^{1,2}

In relation to this particular aspect of rehabilitation of the nerve deaf patient, one of us (D. C. G.), recently has observed a most interesting phenomenon which could prove to be of unlimited value. It is entirely new to us, and we have been unable to find any reference to it in otological or audiological literature.

THE BINAURAL-TIME-DELAY STIMULUS.

Several interesting observations have been made concerning binaural-time-delayed auditory stimuli on hearing. This is achieved by using two separate systems of sound amplification with one sound source, and varying the time relationship of the output of one receiver to the other by 1/400 to 1/25 of a second.

In equal binaural hearing, when intensity is increased 45 db. above the speech reception threshold, discrimination is hampered by an increased amount of distortion; but, when using the time-delayed-stimulus, the intensity can vary from high to low, or low to high, and there is little or no subjective evidence of distortion. Intensity can be increased to 120-130 db. while using the time-delayed system, and no apparent feeling of pain is experienced; but, if one earphone is cut out, immediately pain and excessive loudness predominate. (There is no change whatsoever on the other earphone. It is on a completely separate circuit, and changing one phone does not affect the operation of the other phone in any way). With orthodox, electrically amplified, binaural hearing, the over-amplification in one ear decreases the discrimination ability of the other ear; but, with the delayed stimulus effect, the ability to discriminate does not seem to be impaired by changes of loudness. It would seem that the amplification of this principle of time-delay to the binaural hearing aid would improve its usefulness, especially

to that group of patients who ordinarily do not tolerate loud sound and who discriminate poorly.

By delaying the sound to one ear, we cause the discharge of impulses to the cerebral cortex at a different time from each ear for a given sound without subjective confusion. This fact is the key to the possible application of this phenomenon to rehabilitation of the nerve-deaf patient. In most amplifying systems, the middle frequencies give pressure waves of a greater magnitude, so that their effect on the higher and weaker frequencies is one of masking.⁴ Thus, sounds with higher frequency components, when heard simultaneously in the two ears, are masked by the lower and middle frequency components; but, by delaying the stimulus slightly in one ear, the initial effect of the sound is minimized as far as masking is concerned, and the discrimination of the higher frequencies are given as much auditory emphasis as the stronger, middle and lower frequencies. The application of this principle to patients with perceptive losses in which the high-frequencies are the most severely affected is obvious.

Further evaluation of this phenomenon is now in process. If these preliminary impressions can be substantiated by controlled observations, an important addition to our armamentarium for rehabilitation of the nerve-deaf patient will have been made.

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ACQUISITION OF TEMPORAL BONES.*†

HOWARD P. HOUSE, M.D.,

and

WILLIAM F. HOUSE, M.D.,

Los Angeles, Calif.

Through laboratory and clinical research, tremendous strides have been made in all phases of otology during the past two decades. Many unknowns remain, however, and many problems are yet to be solved. In order to obtain the solution to these problems it is apparent that more temporal bones and VIIIth nerve pathways will have to be studied in the laboratory, and the results of the laboratory studies correlated with the clinical records of the patient.

Realizing how little we understand about the postoperative results in stapes mobilization, and how great is the need for more anatomical information about it, we decided to approach our private patients with the request that they pledge their middle and inner ear structures, together with the auditory nerve pathways, for research study following death.

METHOD OF APPROACH.

Approximately three weeks following surgery (whether the operation was a success or failure as far as hearing restoration is concerned) each patient is approached as follows:

"There are many phases of the mechanism of hearing that medical science does not yet understand. For instance, why did your operation result in an improvement in hearing and yet another patient with the same hearing problem and operated on in the same way fail to obtain an improvement?

*Read at the meeting of the Otosclerosis Study Group, Feb. 7, 1957.

†The Los Angeles Foundation of Otology was established for us by patients in 1947. It is incorporated under Federal and State Laws as a non-profit corporation dedicated to research, education and charity in the field of otology. The Foundation is supported by grants received primarily from patients and friends, and it is affiliated with the University of Southern California School of Medicine.

Editor's Note: This manuscript received in The Laryngoscope Office and accepted for publication Feb. 19, 1957.

One way you could help medical science in the field of hearing would be to pledge your ear bones to the Los Angeles Foundation of Otology on your death. (A brochure of the Foundation is given to the patient, along with an explanation of its purpose). Scientists working in our laboratories will then carefully examine your ear bones and the little nerve of hearing under a microscope. Their observations will be compared with your office record. In that way, additional information about hearing will be obtained. Because of this additional information, those coming along in the next generation may not have to face the many problems you have encountered. Since otosclerosis is hereditary, you never know whom you may be helping by this pledge.

"I do not want you to commit yourself regarding this matter at this time. You give it some thought, talk it over at home and in a week or two the Foundation will send you some papers. If you decide you would like to pledge your ear bones to this cause you simply sign the papers, together with your next of kin, file one set with your official Will and return one set to our office. In this way you will have indeed made a wonderful contribution to the advancement of our knowledge of hearing problems."

LEGAL DOCUMENT.

The Foundation attorneys, after due investigation, and in cooperation with the Legal Staff of the Los Angeles County Medical Association, recommended the following documents for signature:

PLEDGE OF TEMPORAL BONES FOR EAR RESEARCH.

Know All Men By These Presents:

I, _____, do hereby request that immediately following my death, my temporal bones (middle and inner ear portions) be removed from within my head, including the hearing nerve and its central pathways, and given to the Los Angeles Foundation of Otology for the purpose of dissection and microscopic examination to determine the causes and cures of ear disease and deafness.

Permission is hereby granted by this document to any medical doctor, coroner, or other qualified person, to remove these bones for disposition as directed by the Los Angeles Foundation of Otology.

I request that my attending physician, or my next of kin, immediately telephone the Los Angeles Foundation of Otology (DUmkirk 4-2531) day or night, for instructions regarding the removal and preservation of these temporal bones.

Executed this.....day of....., 19....., in the City
of....., State of.....

.....	Witness	.....	Name
.....	Witness	.....	Address

DECLARATION OF CONSENT.

I/we, being nearest of kin to the signer of the pledge to the Los Angeles Foundation of Otology, do hereby consent to the removal of the temporal bones (middle and inner ear portions) from within the head, including the hearing nerve and its central pathways, immediately following his/her death, and will in every way possible carry out all the instructions as set forth in the above pledge signed by.....

I/we, further understand that in the event of death, I/we will direct the attending physician, coroner, or the autopsy surgeon to call, collect, immediately DUnkirk 4-2531 in Los Angeles, California, day or night, and request the call be transferred to the Los Angeles Foundation of Otology, or to its present Director, Howard P. House, M.D. Directions will then be given for the removal and preservation of these temporal bones and nerves.

Signed this.....day of....., 19....., in the City
of....., State of.....

.....	Name	.....	Relationship
.....		.....	Address
.....	Name	.....	Relationship
.....		.....	Address

LETTER WHICH ACCOMPANIES THE PLEDGE AND CONSENT OF NEXT OF KIN.

Enclosed are the papers that you may use to pledge your ear bones and nerve pathways to the Los Angeles Foundation of Otology for research purposes.

I would suggest that you and your next of kin sign the enclosed papers and place both original forms with your official Will. I would appreciate it if you would sign the duplicate forms also and return them to me to be kept in the files of the Los Angeles Foundation of Otology.

By this act you will have made a wonderful contribution to medical science and to those in the generations to come who may have similar ear problems.

(A brochure of the Foundation is enclosed with with communication.)

PATIENT RESPONSE.

Patients often remark that they wondered why such an opportunity to contribute to research in hearing had not been made available previously. They seem delighted that they can be of help in seeking the solutions of hearing problems.

PROCEDURE AFTER DEATH OCCURS.

The attending physician notifies the Foundation by telephone of the death of the patient. At that time the physician is told what steps should be taken to obtain the temporal bones and nerve pathways. Funds are set aside by the Foundation to pay a suitable fee to the autopsy surgeon, to the attending physician, as well as to the consulting otolaryngologist to encourage them to obtain immediately the temporal bones, and to preserve and forward them to the Foundation.

RESULTS.

Some three months after the institution of this program no less than 300 private patients have signed these forms and returned the duplicate forms to the Foundation files. Less than ten per cent of the patients approached refused to sign. The patients who refused acknowledged the value of such a program and explained that their refusals were based on religious beliefs.

The program has been so well received by patients that we now approach even single visit new patients who have unusual ear problems.

This program is of value in three ways:

1. Considerable anatomical material which otherwise would be lost, becomes available ultimately for microscopic study and clinical correlation.
2. Interestingly enough, the request to contribute to a research program enhances the respect of the patient for the doctor. It assures the patient of the doctor's complete interest in the work he is attempting to do.
3. Patients not only are pleased to contribute their ear bones to the Foundation for study, but often assist further with monetary contributions to the research project.

It is sincerely hoped that many other otologists will join this program. Some thought might well be given to a national centralized laboratory, where such anatomical material can be processed and filed for future posterity.

INTERNATIONAL CONFERENCE ON AUDIOLOGY.

St. Louis, Missouri, U.S.A., May 13-16, 1957.

TENTATIVE PROGRAM OF TECHNICAL SESSIONS.

(Auditorium, Washington University School of Medicine)

Tuesday morning, May 14, 1957: Contributed papers.

Tuesday afternoon, May 14, 1957: "Assessment of Auditory Function."

- I. Hearing in Children—Panel Discussion—S. Richard Silverman, St. Louis, Mo., *Moderator*.

Panel members: Robert Goldstein, St. Louis, Mo.; William G. Hardy, Baltimore, Md.; Helmer R. Myklebust, Evanston, Ill.; Louise Trenque, Lyon, France.

- II. Diagnosis of Hearing Disorders.

Audiometry in Diagnosis: Raymond Carhart, Evanston, Ill.; Meniere's Disease: Theodore E. Walsh, St. Louis; Cochlear vs. Retrocochlear Lesions: Tauno Palva, Turku, Finland; Clinical Aspects of Cortical Deafness: Ettore Bocca, Milan, Italy.

Wednesday morning, May 15, 1957: "Physiology of Hearing;" Harvey Fletcher, Provo, Utah, *Chairman*.

- I. Process of Sound Conduction: Merle Lawrence, Ann Arbor, Mich.; Technical Discussion: Henning E. von Gierke, Dayton, Ohio; Clinical Discussion: Terrence E. Cawthorne, London, England; Film: Heinrich G. Kobrak, Detroit, Mich.
- II. Transmission and Transduction in the Cochlea: Hallowell Davis, St. Louis; Film: George von Békésy, Cambridge, Mass. (in absentia); Theoretical Discussion: J. C. R. Licklider, Cambridge, Mass.; Clinical Discussion: John R. Lindsay, Chicago, Ill.

Wednesday afternoon, May 15, 1957: "Physiology of Hearing: S. Smith Stevens, Cambridge, Mass., *Chairman*.

III. Transmission in the Central Nervous System: Robert Galambos, Washington, D. C.; Physiological Discussion: Ichiji Tasaki, Bethesda, Md.; Anatomical Discussion: Grant Rasmussen, Bethesda, Md.; Clinical Discussion: J. S. Riesco-MacClure, Santiago, Chile.

IV. Functions of the Auditory Cortex: W. Dewey Neff, Chicago, Ill.; Physiological Discussion: Archie Tunturi, Portland, Ore.; Clinical Discussion (Neurology): Robert King, St. Louis, Mo.; Clinical Discussion (Otology): Harold Schuknecht, Detroit, Mich.

Thursday morning, May 16, 1957: "Hearing Loss and Noise Exposure."

I. Noise in Industry: Jerome R. Cox, Jr., St. Louis.

II. Hearing Loss in Industry: Aram Glorig, Los Angeles, Calif.

III. A Laboratory Method for the Study of Acoustic Trauma: Donald H. Eldredge, Walter P. Covell, St. Louis, Mo.

IV. Diagnosis, Susceptibility and Presbycusis: Gordon Hoople, Syracuse, N. Y.

V. Ear Protection: Joseph Zwislocki, Cambridge, Mass.

VI. The Concept of Noise Exposure: Walter A. Rosenblith, Cambridge, Mass.

Thursday afternoon, May 16, 1957: Contributed Papers.

UNIVERSITY OF ILLINOIS.

The next course in Laryngology and Bronchoesophagology to be given by the University of Illinois College of Medicine is scheduled for November 4-16, 1957, under the direction of Dr. Paul H. Holinger.

Interested registrants will please write directly to the Department of Otolaryngology, University of Illinois College of Medicine, 1853 West Polk Street, Chicago 12, Illinois.

DIRECTORY OF OTOLARYNGOLOGIC SOCIETIES.

(Secretaries of the various societies are requested to keep this information up to date).

AMERICAN OTOLOGICAL SOCIETY.

President: Dr. John R. Lindsay, 950 East 59th Street, Chicago 37, Ill.
Vice-President: Dr. Dean M. Lierle, University Hospital, Iowa City, Iowa.
Secretary-Treasurer: Dr. Lawrence R. Boies, University Hospital, Minneapolis 14, Minn.
Editor-Librarian: Dr. Henry L. Williams, Mayo Clinic, Rochester, Minn.
Meeting: Statler Hotel, Washington, D. C., May 4, 1957.

AMERICAN LARYNGOLOGICAL ASSOCIATION.

President: Dr. LeRoy A. Schall, Boston, Mass.
First Vice-President: Dr. Henry M. Goodyear, Cincinnati, Ohio.
Second Vice-President: Dr. Robert E. Priest, Minneapolis, Minn.
Secretary: Dr. Harry P. Schenck, Philadelphia, Pa.
Treasurer: Dr. Fred W. Dixon, Cleveland, Ohio.
Meeting: Statler Hotel, Washington, D. C., May 3, 1957.

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC.

President: Dr. Percy Ireland, Toronto, Canada.
President-Elect: Dr. Lewis F. Morrison.
Secretary: Dr. C. Stewart Nash, 277 Alexander St., Rochester, N. Y.
Meeting: Statler Hotel, Washington, D. C., May, 1957.

AMERICAN MEDICAL ASSOCIATION, SECTION ON LARYNGOLOGY, OTOTOLOGY AND RHINOLOGY.

Chairman: Dr. Gordon D. Hoople, Syracuse, N. Y.
Vice-Chairman: Dr. Kenneth L. Craft, Indianapolis, Ind.
Secretary: Dr. Hugh A. Kuhn, Hammond, Ind.
Representative to Scientific Exhibit: Walter Heck, M.D., San Francisco, Calif.
Section Delegate: Gordon Harkness, M.D., Davenport, Iowa.
Alternate Delegate: Dean Lierle, M.D., Iowa City, Iowa.

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY.

President: Dr. Algernon B. Reese, 73 East 71st St., New York 21, N. Y.
Executive Secretary: Dr. William L. Benedict, Mayo Clinic, Rochester, Minn.
Meeting: Palmer House, Chicago, Ill., Oct. 13-19, 1957.

AMERICAN BRONCHO-ESOPHAGOLOGICAL ASSOCIATION.

President: Dr. Clarence W. Engler, 2323 Prospect Ave., Cleveland, Ohio.
Secretary: Dr. F. Johnson Putney, 1719 Rittenhouse Square, Philadelphia, Pa.
Meeting: Mark Hopkins Hotel, San Francisco, Calif., May 21-23, 1958.

AMERICAN BOARD OF OTOLARYNGOLOGY.

Meeting: Palmer House, Chicago, Ill., October 6-12, 1957.

THE AMERICAN RHINOLOGIC SOCIETY.

President: Dr. Ralph H. Riggs, 1513 Line Ave., Shreveport, La.
Secretary: Dr. James Chesson, 1829 High St., Denver, Colo.
Annual Clinical Session: Illinois Masonic Hospital, Chicago, Illinois,
October, 1956.
Annual Meeting: Palmer House, Chicago, Illinois, October, 1957.

AMERICAN SOCIETY OF OPHTHALMOLOGIC AND OTOLARYNGOLOGIC ALLERGY.

President: Dr. Sam H. Sanders, 1089 Madison Ave., Memphis 3, Tenn.
Secretary-Treasurer: Dr. Michael H. Barone, 468 Delaware Ave., Buffalo
2, N. Y.
Meeting: Palmer House, Chicago, Ill., October, 1957.

AMERICAN SOCIETY OF FACIAL PLASTIC SURGERY.

President: Dr. Irvin J. Fine, 506 New Brunswick Ave., Perth Amboy,
N. J.
Secretary: Dr. William Schwartz, 224 Lexington Ave., Passaic, N. J.
Meetings: Quarterly.

OTOSCLEROSIS STUDY GROUP.

President: Dr. Joseph A. Sullivan, 174 St. George St., Toronto 5, Canada.
Secretary: Dr. Arthur L. Jones, 611 Brown Bldg., Lexington, Ky.
Treasurer: Dr. Lawrence H. Boies, University Hospital, Minneapolis
14, Minn.
Meeting: Palmer House, Chicago, Ill., October, 1957.

AMERICAN OTORHINOLOGIC SOCIETY FOR THE ADVANCEMENT OF PLASTIC AND RECONSTRUCTIVE SURGERY.

President: Dr. Joseph Glibert, 111 E. 61st St., New York, N. Y.
Vice-President: Dr. Kenneth Hinderer, 402 Medical Arts Bldg., Pitts-
burgh, Pa.
Secretary: Dr. Louis Joel Feit, 66 Park Ave., New York 16, N. Y.
Treasurer: Dr. Arnold L. Caron, 36 Pleasant St., Worcester, Mass.

PAN AMERICAN ASSOCIATION OF OTO-RHINO-LARYNGOLOGY AND BRONCHO-ESOPHAGOLOGY.

President: Dr. Jose Gros, Havana, Cuba.
Executive Secretary: Dr. Chevalier L. Jackson, 3401 N. Broad St., Phila-
delphia 40, Pa., U. S. A.
Meeting: Sixth Pan American Congress of Oto-Rhino-Laryngology and
Broncho-Esophagology.
Time and Place: Brazil, 1958.

SIXTH INTERNATIONAL CONGRESS OF OTOLARYNGOLOGY.

President: Dr. Arthur W. Proetz, Beaumont Bldg., St. Louis, Mo.
General Secretary: Dr. Paul Holinger, 700 No. Michigan Ave., Chicago
11, Ill.
Meeting: Statler Hotel, Washington, D. C., May 5 - 10, 1957.

THE PHILADELPHIA LARYNGOLOGICAL SOCIETY.

President: Dr. Chevalier L. Jackson.
Vice-President: Dr. John J. O'Keefe.
Treasurer: Dr. Joseph P. Atkins.
Secretary: Dr. Louis E. Silcox.
Historian: Dr. Herman B. Cohen.
Executive Committee: Dr. Harry P. Schenck, Dr.; Benjamin H. Shuster,
Dr. William A. Lell, Dr.; William J. Hitschler.

BALTIMORE NOSE AND THROAT SOCIETY.

Chairman: Dr. Walter E. Loch, 1039 No. Calvert St., Baltimore, Maryland.
Secretary-Treasurer: Dr. Theodore A. Schwartz.

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY.

President: Dr. Raymond Kerwin, 310 So. Michigan Ave., Chicago, Ill.
Vice-President: Dr. Frank Wojniak, 6132 So. Kedzie Ave., Chicago, Ill.
Secretary-Treasurer: Dr. Stanton A. Friedberg, 122 So. Michigan Ave.,
Chicago, Ill.
Meeting: First Monday of each Month, October through May.

**CENTRAL ILLINOIS SOCIETY OF OPHTHALMOLOGY
AND OTOLARYNGOLOGY.**

President: Dr. G. C. Otrich, Belleville, Ill.
President-Elect: Dr. Phil R. McGrath, Peoria, Ill.
Secretary-Treasurer: Dr. Alfred G. Schultz, Jacksonville, Ill.

MISSISSIPPI VALLEY MEDICAL SOCIETY.

President: Dr. Arthur S. Bristow, Princeton, Mo.
Secretary-Treasurer: Dr. Harold Swanberg, Quincy, Ill.
Assistant Secretary-Treasurer: Dr. Jacob E. Reisch, Springfield, Ill.

**THE SECTION OF OTOLARYNGOLOGY OF THE MEDICAL SOCIETY
OF THE DISTRICT OF COLUMBIA.**

Chairman: Dr. J. L. Levine.
Vice-Chairman: Dr. Russell Page.
Secretary: Dr. James J. McFarland.
Treasurer: Dr. Edward M. O'Brien.
Meetings are held the second Tuesday of September, November, January,
March and May, at 6:30 P.M.
Place: Army and Navy Club, Washington, D. C.

**SOUTHERN MEDICAL ASSOCIATION,
SECTION ON OPHTHALMOLOGY AND OTOLARYNGOLOGY.**

Chairman: Dr. Sherman B. Forbes, 706 Franklin Street, Tampa, Florida.
Vice-Chairman: Dr. G. E. McKenzie, 602 DuPont Building, Miami 32, Fla.
Chairman-Elect: Dr. V. Eugene Holcombe, Medical Arts Building,
Charleston, West Virginia.
Secretary: Dr. G. Slaughter Fitz-Hugh, 104 East Market Street, Char-
lottesville, Virginia.

**THE VIRGINIA SOCIETY OF OPHTHALMOLOGY
AND OTOLARYNGOLOGY.**

President: Dr. Benjamin Sheppard, 301 Medical Arts Building, Rich-
mond, Virginia.
President-Elect: Dr. Emanuel U. Wallerstein, Professional Building,
Richmond, Virginia.
Vice-President: Dr. Calvin T. Burton, Medical Arts Building, Roanoke,
Virginia.
Secretary-Treasurer: Dr. Maynard P. Smith, 600 Professional Building,
Richmond, Virginia.
Meeting: Roanoke, Virginia, December 6 and 7, 1957.

**WEST VIRGINIA ACADEMY OF OPHTHALMOLOGY
AND OTOLARYNGOLOGY.**

President: Dr. James K. Stewart, Wheeling, W. Va.
Secretary-Treasurer: Dr. Frederick C. Reel, Charleston, W. Va.
Annual Meeting: Greenbrier, White Sulphur Springs, W. Va., May 31st
through June 1st.

**THE LOUISIANA-MISSISSIPPI OPHTHALMOLOGICAL
AND OTOLARYNGOLOGICAL SOCIETY.**

President: Dr. H. K. Rouse, 1300 27th Ave., Gulfport, Miss.
Vice-President: Dr. A. J. McComiskey, 3420 Prytonia St., New Orleans, La.
Secretary: Dr. Edley H. Jones, 1301 Washington St., Vicksburg, Miss.
Meeting: The Edgewater Gulf Hotel, Edgewater Park, Miss., May 17-18,
1957.

NORTH CAROLINA EYE, EAR, NOSE AND THROAT SOCIETY.

President: Dr. J. C. Peele, Kinston Clinic, Kinston, N. C.
Vice-President: Dr. George E. Bradord, Winston-Salem, N. C.
Secretary-Treasurer: Dr. J. D. Stratton, 1012 Kings Drive, Charlotte 7,
N. C.
Meeting: Hendersonville, N. C., Skyland Hotel, Sept. 14-18, 1957.

**SOUTH CAROLINA SOCIETY OF OPHTHALMOLOGY
AND OTOLARYNGOLOGY.**

President: Dr. James H. Gressette, Orangeburg, S. C.
Vice-President: Dr. Robert P. Jeanes, Easley, S. C.
Secretary-Treasurer: Dr. Roderick Macdonald, 333 East Main St., Rock Hill, S. Car.
Meeting: Hendersonville, N. C., Skyland Hotel, Sept. 15-18, 1957.

**FLORIDA SOCIETY OF OPHTHALMOLOGY
AND OTOLARYNGOLOGY.**

President: Dr. Chas. C. Grace, 145 King St., St. Augustine, Fla.
President-Elect: Dr. Jos. W. Taylor, 706 Franklin St., Tampa, Fla.
Secretary-Treasurer: Dr. Carl S. McLemore, 1217 Kuhl Ave., Orlando, Fla.

THE GREATER MIAMI EYE, EAR, NOSE AND THROAT SOCIETY.

President: Dr. M. A. Schofman.
Vice-President: Dr. Max M. Kulvin.
Secretary-Treasurer: Dr. James H. Mendel, Jr., 7241 Red Road, Miami 43, Florida.
Meeting quarterly (March, May, October and December), on the second Thursday of the month, 6:30 P.M. at Seven Seas Restaurant.

**DALLAS ACADEMY OF OPHTHALMOLOGY
AND OTOLARYNGOLOGY**

President: Dr. Ludwig A. Michael, 3707 Gaston Ave., Dallas, Tex.
Vice-President: Dr. Hal W. Maxwell.
Secretary-Treasurer: Dr. Edward A. Newell, 1511 No. Beckley, Dallas 8, Tex.

**LOS ANGELES SOCIETY OF OPHTHALMOLOGY
AND OTOLARYNGOLOGY.**

President: Dr. Sol Rome.
Secretary-Treasurer: Dr. Max E. Pohlman.
Chairman of Ophthalmology Section: Dr. Richard Kratz.
Secretary of Ophthalmology Section: Dr. Carrall A. McCoy.
Chairman of Otolaryngology Section: Dr. Howard G. Gottschalk.
Secretary of Otolaryngology Section: Dr. Robert W. Godwin.
Place: Los Angeles County Medical Association Bldg., 1925 Wilshire Blvd., Los Angeles, Calif.
Time: 6:30 P. M. last Monday of each month from September to June, inclusive—Otolaryngology Section. 6:30, first Thursday of each month from September to June, inclusive—Ophthalmology Section.

PACIFIC COAST OTO-OPHTHALMOLOGICAL SOCIETY.

President: H. Leroy Goss, M.D., 620 Cobb Bldg., Seattle 1, Washington.
Secretary-Treasurer: Homer E. Smith, M.D., 508 East South Temple, Salt Lake City, Utah.
Meeting: April 7-11, 1957.

THE SOCIETY OF MILITARY OTOLARYNGOLOGISTS.

President: Col. Wendell A. Weller.
Secretary-Treasurer: Major Stanley H. Bear, M.C., 3810th USAF Hospital, Maxwell AFB, Alabama.
Time and place of meeting: October 1957, Palmer House, Chicago, Ill.

THE RESEARCH STUDY CLUB OF LOS ANGELES, INC.

Chairman: Dr. Orrie E. Ghrist, 210 N. Central Ave., Glendale, Calif.
Treasurer: Dr. Norman Jesberg, 500 So. Lucas Ave., Los Angeles 17, Calif.
Otolaryngology: Dr. Russell M. Decker, 65 N. Madison Ave., Pasadena 1, Calif.
Ophthalmology: Dr. Warren A. Wilson, 1930 Wilshire Blvd., Los Angeles 57, Calif.
Mid-Winter Clinical Convention annually, the last two weeks in January at Los Angeles, Calif.

**PUDGET SOUND ACADEMY OF OPHTHALMOLOGY
AND OTOLARYNGOLOGY**

President: Dr. Clifton E. Benson, Bremerton, Wash.
President-Elect: Dr. Carl D. F. Jensen, Seattle, Wash.
Secretary: Dr. Willard F. Goff, 1215 Fourth Ave., Seattle, Wash.

**CANADIAN OTOLARYNGOLOGICAL SOCIETY
SOCIÉTÉ CANADIENNE D'OTOLARYNGOLOGIE**

President: Dr. G. M. T. Hazen, 208 Canada Bldg., Saskatoon, Sask.
Secretary: Dr. G. Arnold Henry, 170 St. George St., Toronto, Ontario.
Meeting: Banff Springs Hotel, Banff, Canada, June 17-19, 1957.

INTERNATIONAL BRONCHESOPHAGOLOGICAL SOCIETY.

President: Dr. Theodor Hunermann, Dusseldorf, Germany.
Secretary: Dr. Chevallier L. Jackson, 3401 N. Broad St., Philadelphia 40,
Pa., U. S. A.
Meeting: Sixth International Congress of Bronchoesophagology, Philadelphia, May 12-13, 1957.

**FOURTH LATIN-AMERICAN CONGRESS OF
OTORINOLARINGOLOGIA.**

President: Dr. Dario.
Secretary:
Meeting: Lima, Peru, 1957.

SOCIEDAD NACIONAL DE CIRUGIA OF CUBA.

Presidente: Dr. Reinaldo de Villers.
Vice-Presidente: Dr. César Cabrera Calderín.
Secretario: Dr. José Xirau.
Tesorero: Dr. Alfredo M. Petit.
Vocal: Dr. José Gross.
Vocal: Dr. Pedro Hernández Gonzalo.

**FIRST CENTRAL AMERICAN CONGRESS OF
OTORHINOLARYNGOLOGY.**

President: Dr. Victor M. Noubleau, San Salvador.
Secretary-Treasurer: Dr. Hector R. Silva, Calle Arce No. 84, San Salvador, El Salvador, Central America.

SOCIEDAD CUBANA DE OTO-LARINGOLOGIA.

President: Dr. Reinaldo de Villiers.
Vice-President: Dr. Jorge de Cárdenas.
Secretary: Dr. Pablo Hernandez.

SOCIEDAD DE ESTUDIOS CLINICOS DE LA HABANA.

Presidente: Dr. Frank Canosa Lorenzo.
Vice-Presidente: Dr. Julio Sanguliy.
Secretario: Dr. Juan Portuondo de Castro.
Tesorero: Dr. Luis Ortega Verdes.

MEXICAN ASSOCIATION OF PLASTIC SURGEONS.

President: Dr. Cesar LaBoide, Mexico, D. F.
Vice-President: Dr. M. Gonzales Ulloa, Mexico, D. F.
Secretary: Dr. Juan De Dios Peza, Mexico, D. F.

**FEDERACION ARGENTINA,
DE SOCIEDADES DE OTORRINOLARINGOLOGIA.**

Secretary of the Interior: Prof. Dr. Attilio Viale del Carril.
Secretary of Exterior: Dr. Aldo G. Remorino.
Secretary Treasury: Prof. Dr. Antonio Carrascosa.
Pro-Secretary of the Interior: Prof. Dr. Carlos P. Mercandino.
Pro-Secretary of the Exterior: Prof. Dr. Jaime A. del Sel.
Pro-Secretary of the Treasury: Dr. Jorge Zubizarreta.

BUENOS AIRES CLUB OTOLARINGOLOGICO.

Presidente: Dr. K. Segre
Vice-Presidente: Dr. A. P. Belou.
Secretario: Dr. S. A. Aranz.
Pro-Secretario: Dr. J. M. Tato.
Tesorero: Dr. F. Games.
Pro-Tesorero: Dr. J. A. Bello.

SOCIEDAD COLUMBIANA DE OFTALMOLOGIA Y OTORRINOLARINGOLOGIA (BOGOTA, COLUMBIA).

Presidente: Dr. Alfonso Tribin P.
Secretario: Dr. Felix E. Lozano.
Tesorero: Dr. Mario Arenas A.

ASOCIACION DE OTORRINOLARINGOLOGIA Y BRONCOESOFAGOLOGIA DE GUATEMALA.

Presidente: Dr. Julio Quevedo, 15 Calle Oriente No. 5.
First Vice-Presidente: Dr. Héctor Cruz, 3a Avenida Sur No. 72.
Second Vice-Presidente: Dr. José Luis Escamilla, 5a Calle Poniente No. 48.
Secretario-Tesorero: Dr. Horace Polanco, 13 Calle Poniente No. 9-D.

SOCIEDAD DE OTO-RINO-LARINGOLOGIA, COLEGIO MEDIO DE EL SALVADOR, SAN SALVADOR, C. A.

President: Dr. Salvador Mixco Pinto.
Secretary: Dr. Daniel Alfredo Alfaro.
Treasurer: Dr. Antonio Pineda M.

SOCIEDAD ESPANOLA DE OTORRINOLARINGOLOGIA.

Presidente: Dr. D. Adolfo Hinojar Pons.
Vice-Presidente: Dr. D. Jose Perez Mateos.
Secretario General: Dr. D. Francisco Marañés.
Tesorero: Dr. D. Ernesto Alonso Ferrer.

SOCIEDAD OTO-RINO-LARINGOLOGIA DE LOS HOSPITALES DE MADRID.

Presidente: Dr. Don Fernando Beltrán Castillo.
Secretario General: Dr. Don Alfonso Vassallo de Mumbert.
Tesorero: Dr. Don Rafael García Tapia.

PORTUGUESE OTORHINOLARYNGOLOGICAL SOCIETY.

President: Dr. Albert Luis de Mendonca.
Secretary: Dr. Antonio da Costa Quinta, Avenida, de Liberdade 65, 1° Lisbon.

SOCIEDADE PORTUGUESA DE OTORRINOLARINGOLOGIA E DE BRONCO-ESOFAGOLOGIA.

Presidente: Dr. Alberto Luis De Mendonca.
Vice-Presidente: Dr. Jaime de Magalhaes.
1.º Secretario: Dr. Antonio da Costa Quinta.
2.º Secretario: Dr. Albano Coelho.
Tesoureiro: Dr. Jose Antonio de Campos Henriques.
Vogals: Dr. Teófilo Esquivel.
Dr. Antonio Canceia de Amorim.
Sede: Avenida da Liberdade, 65, 1º, Lisboa.

SOCIEDAD VENEZOLANA DE OTORRINOLARINGOLOGIA.

Presidente: Dr. Alfredo Celis Pérez.
Vice-Presidente: Dr. Bustamante Miranda.
Secretario General: Dr. Jesús Miralles.
Tesorero: Dr. M. Matheus.
Vocales: Dr. Perez Velasquez and Dr. Wilmer Palacios.

**SOCIEDAD DE OTORRINOLARINGOLOGIA Y
BRONCOESOFAGOSCOPIA DE CORDOBA.**

Presidente: Dr. Aldo Remorino.
Vice-Presidente: Dr. Luis E. Olsen.
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CONTENTS

CARCINOMA OF THE ANTRUM; AN ANALYSIS OF 60 CASES, WITH SPECIAL REFERENCE TO PRIMARY SURGICAL EXTIRPATION. Harold G. Tabb, M.D., New Orleans, La. - - - - -	269
ABNORMAL PATENCY OF THE EUSTACHIAN TUBE: SURGICAL TREAT- MENT. Kinsey M. Simonton, M.D. - - - - -	342
SURGICAL MANAGEMENT OF LARYNGEAL DISORDERS BY THE LARYNGO- FISSURE APPROACH. Bert DeBord, M.D. - - - - -	360
CONFIRMATION OF NORMAL DISCRIMINATION LOSS FOR SPEECH ON C. I. D. AUDIOTORY TEST W-22. John F. Corso, Ph.D. - - - - -	365
REHABILITATION OF THE NERVE-DEAF PATIENT: THE BINAURAL- TIME-DELAY STIMULUS. W. P. Anthony, M.D., and Donald C. Gasaway, M.A. - - - - -	371
ACQUISITION OF TEMPORAL BONES. Howard P. House, M.D., and William F. House, M.D. - - - - -	374
INTERNATIONAL CONFERENCE ON AUDIOLOGY, MAY 13-16, 1957 - -	378
DIRECTORY OF OTOLARYNGOLOGIC SOCIETIES - - - - -	380

4

59

42

50

55

71

74

78

80